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datum inc.

Timing Instrumentation

TECHNICAL MANUAL

MODEL 9300A
TIME CODE
GENERATOR/TRANSLATOR
PART NO. 9300-7509

D.1958,029

PROP # 0240-578

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MANUAL ADDENDUM

EQUIPMENT CONFIGURATION

The Model 9300 Time Code Generator/Translator (TCG/T) consists of a basic unit, to which optional features are added. Sections One through Five of this manual describe the basic 9300 TCG/T. Material pertaining to optional features is contained in Appendix B.

This Addendum supersedes any conflicting specifications, operational features, or functions described in the basic manual.

The Model 9300-7509 TCG/T contains the following modifications and/or optional features:

1. IRIG B DC CODE OUTPUT (B002)
   a. Output connector is J4B (BNC)
   b. TTL compatible output, 0 to +5 VDC (positive true).
   c. See Assembly 16062 (32) for logic.

2. The "DAYS" portion of the standard generator/translator has been deleted.

3. GROUP BINARY PARALLEL OUTPUTS
   a. See Assemblies 16737 and 16669 for logic.
   b. Group binary outputs are as follows:

Milliseconds	10 Bits
Seconds	6 Bits
Minutes	6 Bits
Hours	5 Bits

   c. Outputs are TTL positive true.
   d. Sample time pulse is normally true pulsing to a logic "0" (GND) for approximately 1.5 microseconds at update time (1 KPPS rate).
   e. Output connector is J5.
   f. See Top Assembly drawing for specific dash number configuration.
   g. For pin assignments, see this Addendum and/or Assembly 16669.

4. SPECIAL CONTROL FUNCTION ENCODE/DECODE.

Control Function bits 50, 51, and 52 have been encoded into the IRIG B output code in the GENERATE mode. The origin of these three bits is determined by the front panel LOCAL/REMOTE switch. When in the LOCAL mode, these bits are selected by the front panel PRESET thumbwheel switch, and loaded by a front panel push button switch. (This is the switch that is normally used to load Tens of Days). When in the REMOTE mode, these three bits are input via rear panel connector J4A (See the Switch & Control Logic drawing 9300-8999 for pin assignments).

The three CF bits have the weight of a BCD number (CF 50 = 2^0, CF51 = 2^1, CF52 = 2^2) and are displayed as a decimal number (0-7) in the display digit normally used for Tens of Days. This displayed digit is operational in either local or remote, generate or translate. (See Modification Drawing 9300-80000).

Control Function bits 50, 51, and 52 are decoded and displayed from the IRIG B input code in the TRANSLATE mode. These decoded bits are also output as parallel data on connector J5. The output term names are "OUT 1", "OUT 2", and "OUT 3" respectivly.

PIN ASSIGNMENTS

Connector J5

Group Binary

Pin	Signal	Pin	Signal
1	MS1	28	OUT 1
2	MS2	29	OUT 2
3	MS4	30	OUT 3
4	MS8	31	OUT 4
5	MS16	32	OUT 5
6	MS32	33	
7	MS64	34	SAMPLE TIME 2
8	MS128	35	GROUND
9	MS256	36	GROUND
10	MS512		
11	SEC1		
12	SEC2		
13	SEC4		
14	SEC8		
15	SEC16		
16	SEC32		
17	MIN1		
18	MIN2		
19	MIN4		
20	MIN8		
21	MIN16		
22	MIN32		
23	HR1		
24	HR2		
25	HR4		
26	HR8		
27	HR16		

TABLE OF CONTENTS

PARAGRAPH	TITLE	PAGE
SECTION ONE - GENERAL INFORMATION		
1.1	INTRODUCTION	1-1
1.2	GENERAL DESCRIPTION	1-1
1.2.1	Time Code Translation	1-1
1.2.2	Time Code Generation	1-1
1.3	PHYSICAL CONFIGURATION	1-1
1.4	SPECIFICATIONS	1-2
SECTION TWO - INSTALLATION AND OPERATION		
2.1	INSTALLATION	2-1
2.2	OPERATION	2-3
2.2.1	Generate Mode	2-5
2.2.2	Translate Mode	2-5
2.2.3	Error Frame Bypass Operation	2-6
2.2.4	Input Code Direction	2-6
2.2.5	Input Code Polarity	2-6
2.2.6	Input Filter Selection	2-6
SECTION THREE - THEORY OF OPERATION		
3.1	INTRODUCTION	3-1
3.2	DRAWING STRUCTURE	3-1
3.3	GENERAL DESCRIPTION	3-1
3.3.1	Time Code Generation	3-3
3.3.2	Time Code Translation	3-3
3.4	LOGIC DESCRIPTION	3-4
3.4.1	AGC Assembly	3-4
3.4.2	Decoder	3-5
3.4.3	Mode Control	3-8
3.4.4	Scan Logic	3-5
3.4.5	Sync Logic	3-8
3.4.6	Time Base Logic	3-8
3.4.7	Minor Time Counter	3-8
3.4.8	Major Time Counter	3-9
3.4.9	Display Drivers	3-9
3.4.10	IRIG B Encoder	3-9
3.4.11	Power Supply	3-12
3.5	GLOSSARY OF LOGIC TERMS	3-13
SECTION FOUR - ADJUSTMENTS		
4.1	INTRODUCTION	4-1
4.2	SINE WAVE SHAPER/MODULATOR	4-1
4.3	POWER SUPPLY	4-1

TABLE OF CONTENTS (cont'd)

PARAGRAPH	TITLE	PAGE
SECTION FIVE - MAINTENANCE		
5.1	GENERAL	5-1
5.2	DRAWING STRUCTURE	5-1
5.3	LOCATING COMPONENTS	5-2
5.4	INSPECTION	5-2
5.5	PRINTED CIRCUIT BOARD REPAIR	5-3
SECTION SIX - DRAWINGS		6-1
SECTION SEVEN - LIST OF MATERIALS		7-1
APPENDIX A - TIME CODE FORMATS		
APPENDIX B - OPTIONAL FEATURES		

LIST OF TABLES

TABLE	TITLE	PAGE
1-1	Model 9300 TCG/T Specifications	1-2
2-1	Control and Indicator Functions	2-2
3-1	Glossary Of Logic Terms	3-13

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
1-1	Model 9300 TCG/T Physical Configuration	1-2
2-1	Power Supply Connections	2-2
2-2	Controls and Indicators	2-3
3-1	System Block Diagram	3-2
3-2	AGC Timing	3-4
3-3	Decoder/Sync Mode Timing	3-6
3-4	Minor Time Counter Timing	3-10
3-5	Major Time Counter Timing	3-11

SECTION ONE

GENERAL INFORMATION

1.1 INTRODUCTION

This manual describes the installation, operation and theory of operation of the Datum Model 9300 Time Code Generator/Translator (TCG/T).

The 9300 TCG/T consists of a basic assembly, coupled with optional features specified by the customer. Unless otherwise indicated, the main text of this manual is devoted to the basic assembly. Optional features are described in Appendix B.

1.2 GENERAL DESCRIPTION

The Model 9300 TCG/T performs two principle functions - translation and generation of serial time code signals of prescribed formats. Provisions are made for several optional features which may, or may not be directly related to the two principle functions.

1.2.1 Time Code Translation

When operating in the translation mode, the TCG/T deciphers a serial time code signal received from an external source. Although the standard configuration accommodates the IRIG B format, other time code formats can be translated on an optional basis. As a result of the translation process, the unit automatically displays the appropriate time value and produces a series of pulse rate signals in sync with the translated code.

An error frame bypass feature permits a pre-selected number of code frames exhibiting errors to be bypassed before the internal accumulators are updated to reflect the translated time value. This provides a form of noise rejection by permitting the operator to designate a certain number of frames as being invalid.

1.2.2 Time Code Generation

Selection of the generation mode causes the TCG/T to develop a serial time code (IRIG B in the standard configuration) signal based on internally accumulated time information. Front panel controls permit the internal clock to be started, stopped or preset. Each time digit can be individually set to any value within its normal range.

1.3 PHYSICAL CONFIGURATION

The Model 9300 TCG/T (Figure 1-1) is entirely self contained and is designed for mounting in a standard 19-inch RETMA rack. Controls and indicators are mounted on the front panel, and interface connectors are located at the rear of the unit. All electrical components are mounted on p.c. boards within the chassis. The p.c. boards, as well as the modular power supply, are supported over their entire lengths by aluminium extrusion. The time display is composed of nine LED elements mounted along the front edge of the basic electronics board.

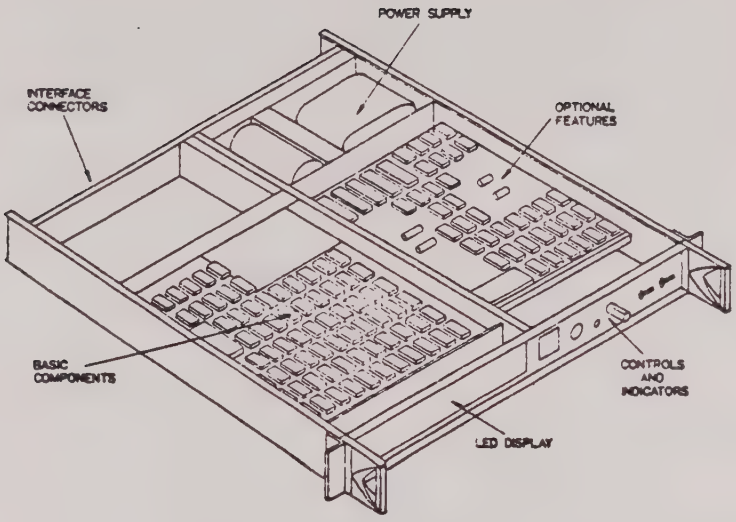


Figure 1-1. Model 9300 TCG/T Physical Configuration (Typical).

1.4 SPECIFICATIONS

Specifications for the Model 9300 TCG/T are listed in Table 1-1.

Table 1-1. Model 9300 TCG/T Specifications

Item	Connector	Specification	
INPUTS			
Power	J6	115/230 VAC ±10% 48 to 420 Hz	
Time Code	J1	Format:	IRIG B BCD time of Year (B122). (Control functions and straight binary seconds may be included in the time code but are not recognized as valid data in the standard instrument.)
		Frequency:	1 kHz
		Ratio:	2:1 - 6:1
		Amplitude:	100 MV p-p to 10V p-p on the mark pulse.
		Input Impedance:	100 K ohm minimum

Table 1-1. Model 9300 TCG/T Specifications (Continued)

Item	Connector	Specification
		Frequency Range: 10 Hz - 300 kHz
		Synchronization Accuracy: Less than ±50 microseconds
OUTPUTS		
IRIG B:	J2	BCD Time of Year (B122)
		NOTE This output is available only when GEN mode is selected.
		Carrier Frequency: 1-kHz sinewave
		Amplitude: Adjustable from 0 to 10V p-p on mark pulse.
		Modulation Ratio: Adjustable from 2:1 through 4:1
		External Load: ≥ 600ohms
Standard Pulse Rates	J3	Rates: 1K pps Pin 1 100 pps Pin 2 10 pps Pin 3 1 pps Pin 4 GND Pin 6
		Duty Cycle: 80/20% 1K pps: 50/50% (In translator mode) On Time Edge: Negative Output Levels: Logic "0" ≤ 0.4 VDC Logic "1" ≥ 2.4 VDC Source Impedance: DTL/TTL Compatible
TIME BASE		
		Type: Crystal Controlled Oscillator Frequency: 1 MHz Stability: ±5 X 10^{-6}
ENVIRONMENT		
		Temperature: 0°C to +50°C Humidity: Up to 95% relative
PHYSICAL		
		Panel Height: 1-3/4 inches Chassis Width: 17 inches Chassis Depth: 18 inches

SECTION TWO

INSTALLATION AND OPERATION

2.1 INSTALLATION

Installation of the Model 9300 TCG/T consists of mounting the unit in a suitable equipment rack, connecting interface cables, and applying the appropriate power. No preliminary adjustments are normally required prior to installation of a basic unit, since all internal settings are performed at the factory. Certain options, such as the propagation delay feature, may require initial setup adjustments; these are described in Appendix B.

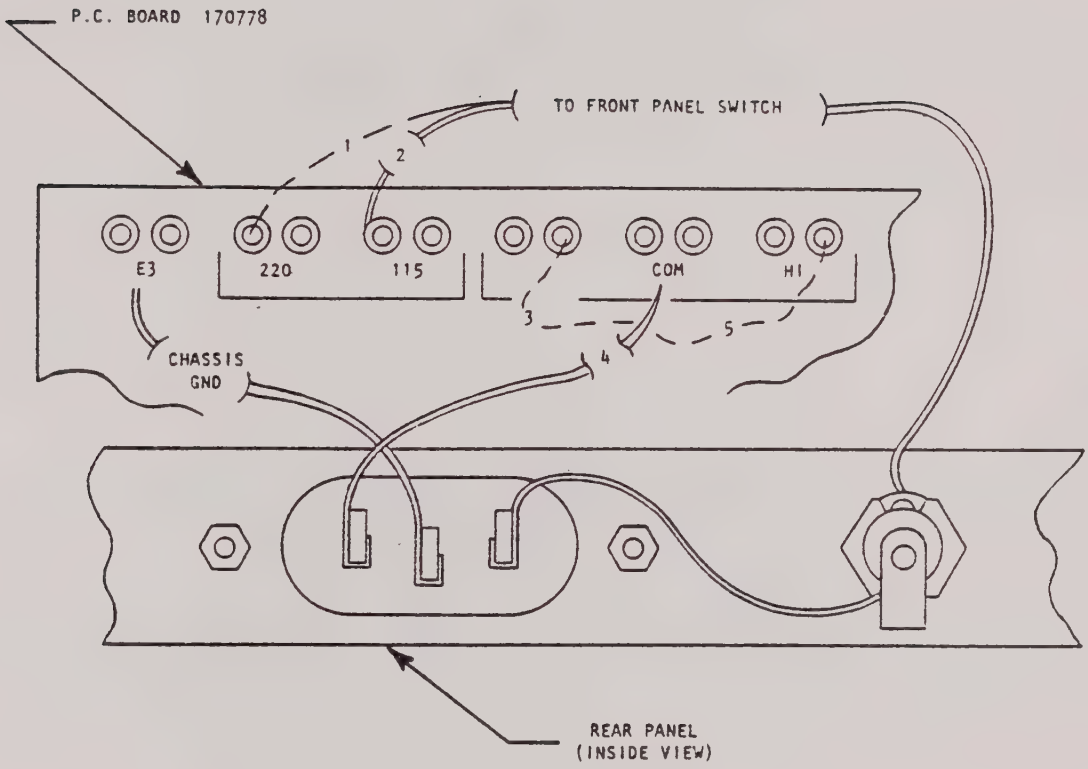
WARNING

Hazardous voltage levels exist in this equipment when power is applied. Exercise extreme caution when protective covers are removed.

Interface signal and primary power characteristics are defined in Table 1-1. Connector pin assignments are listed on the drawings in Section Six.

NOTE

When shipped from the factory, the 9300 TCG/T is normally configured for operation with 115-vac primary power. To alter the unit for 220/230-vac operation, see Figure 2-1.



1. Jumper #1 For 220 VAC Operation
2. Jumper #2 For 115 VAC Operation
3. Jumper #3 For Lo Line Voltage
4. Jumper #4 For Normal Line Voltage
5. Jumper #5 For Hi Line Voltage

Figure 2-1. Power Supply Connections

2.2 OPERATION

The principle functions (translation and generation) of the TCG/T are performed automatically after certain setup procedures are accomplished. These procedures are determined by the selected operating mode, or by the requirements of a specific option. Controls and indicators are shown in Figure 2-2; their functions are described in Table 2-1.

NOTE

Operating instructions for optional features are contained in Appendix B.

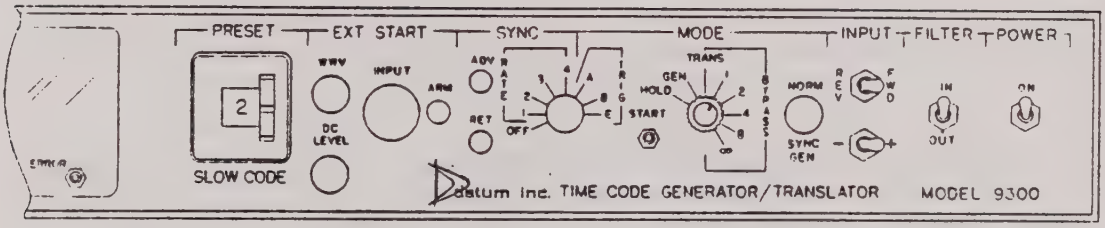


Figure 2-2. Controls and Indicators

Table 2-1. Control and Indicator Functions

Control and Indicator	Function
LED Display	1. Time Display - Nine digits (day, hours, minutes, seconds) reflecting generated or translated time value. 2. ERROR Status - Illuminates during Translate mode.
Time digit pushbutton switches	Activation of each switch sets its respective time digit to value selected by PRESET thumbwheel switch. Used to preset time value during Hold mode.
PRESET thumbwheel switch	Selects preset value for each time digit.
MODE switch	Selects operating mode (Generate or Translate) and error frame bypass value (Hold).
START switch	Activates time code generation when Generate mode is selected after leaving Hold mode.
INPUT FWD/REV switch	Conditions unit to translate code received in either forward or reverse direction.
INPUT +/- switch	Conditions unit to translate code signal of normal (+) or inverted (-) polairity.
FILTER switch	Activates 3-kHz input filter during Translate mode.
POWER switch	Activates primary power.

2.2.1 Generate Mode

a. Activate PWR switch to apply primary power.

b. Set MODE switch to HOLD position. Verify that display is stationary.

c. Preset time-of-day value as follows:

NOTE

When presetting time value, always begin with least-significant digit (units of seconds).

1. Use PRESET thumbwheel switch to select desired value of first digit.

2. Press pushbutton switch beneath first digit in display. Verify that display reflects value selected in step 1.

3. Repeat steps 1 and 2 for remaining digits.

d. Set MODE switch to GEN position. Activate generator by pressing START switch at appropriate time.

2.2.2 Translate Mode

a. Activate PWR switch to apply primary power.

b. Set MODE switch to HOLD position. Verify that display is stationary.

c. Apply 1-kHz modulated IRIG B time code signal to connector J1. Signal must comply with specifications listed in Table 1-1.

NOTE

Optional segments of IRIG B code (control functions and straight binary seconds data) are not processed during translation mode. Their presence or absence has no effect on TCG/T operation.

d. Set MODE switch to TRANS position.

e. Set FWD/REV switch to FWD position. Code synchronization and translation will commence after a delay of approximately 60 seconds.

2.2.3 Error Frame Bypass Operation

The error frame bypass feature is functionally a part of the Translate mode, and is controlled by the MODE switch. A frame bypass ERROR indicator is located next to the unit-seconds digit in the LED display.

When the MODE switch is set to TRANS, the 9300 translates each frame of the incoming code and displays the appropriate value. Any inaccuracies within the code will be reflected by the instrument.

Erroneous readings due to input signal degradation can be avoided by setting the MODE switch to BYPASS 1, 2, 4 or 8. This provides an effective means of input signal noise rejection by permitting the internal counters to be loaded with an updated time value only after 1, 2, 4 or 8 consecutive code frames exhibiting errors are detected. If errors are not encountered in the selected number of consecutive frames, the counters simply operate as accumulators, and are clocked by the carrier component of the modulated time code signal. Setting the MODE switch to BYPASS - INFINITY causes the unit to function as an elapsed-time generator; the internal counters are never updated to conform to the time value in the code.

The ERROR signal illuminates whenever the incoming code and the internal counters reflect different time values.

2.2.4 Input Code Direction

The 9300 TCG/T can be programmed to translate time code signals received in either the forward or reverse directions (typically occurring in tape search operations). On the basic unit, this feature is controlled manually by setting the INPUT - FWD/REV switch to the proper position. The FWD position selects forward translation; REV specifies reverse translation.

When the parallel output option is included in the instrument, remote control via a TTL-compatible input line permits an external device to define the FWD/REV function.

2.2.5 Input Code Polarity

Input time code signals of normal or inverted polarity can be accommodated by the TCG/T in Translation mode. This function is selected by the INPUT +/- switch. Set the switch to "+" for normal polarity, and "-" for inverted polarity.

2.2.6 Input Filter Selection

An internal 3-kHz low-pass filter is included for use in tape playback operations (X1 speed ratio). To activate the filter, set the FILTER IN/OUT switch to the IN position.

When the parallel output option is cincluded, remote control via a TTL-compatible input line (SEARCH) permits an external device to perform filter selection.

SECTION THREE

THEORY OF OPERATION

3.1 INTRODUCTION

This section directed the theory of operation of the basic Model 9300 Time Code Generator/Translator (TCG/T). The instrument will be described in both general and specific terms, using block diagrams and engineering drawings for reference. Optional features are described in Appendix B.

The level of explanation is described to the experienced technician familiar with digital electronics techniques in general, and timing instrumentation specifically.

3.2 DRAWING STRUCTURE

This instrument is designed for modular construction, and the engineering drawings in Section Six are organized accordingly. Generally, each major element of the TCG/T is shown on an individual drawing. Those drawings containing logic circuitry that is referenced within this manual are provided with encircled number in their respective title blocks. These numbers will be employed in the description rather than specific assembly or schematic drawing numbers. Reference numbers will be either encircled or enclosed in parenthesis.

Encircled numbers are also used in the drawings to signify logic signal origin and destination. These designations also refer to encircled numbers in the title blocks of specific drawings.

3.3 GENERAL DESCRIPTION

The basic 9300 TCG/T contains all the elements necessary to generate and translate the IRIG B time code. A block diagram illustrating the basic elements of the unit is shown in Figure 3-1. The encircled numbers appearing in the blocks correspond to encircled numbers in the title blocks of the logic drawings in Section Six.

For the purpose of this description, the internal components will be classified in the following three categories:

1. Central components - elements in this category include the minor and major time counters, mode control logic, display drivers and LED display, switch and control network and power supply.

2. Code generation components - this circuitry is dedicated to generation of the IRIG B time code, and consists of the IRIG B encoder and its associated output modulator.

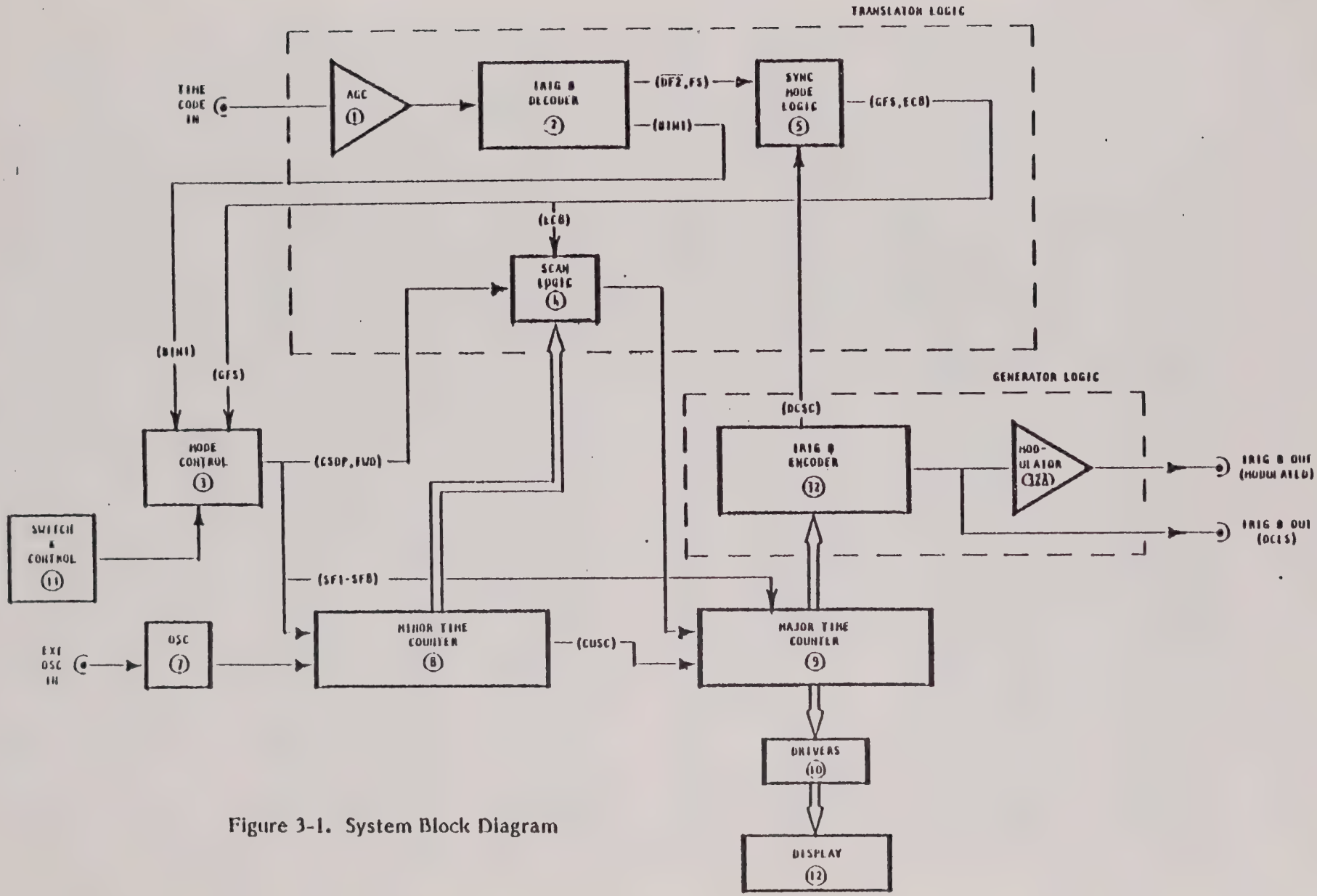


Figure 3-1. System Block Diagram

3. Code translation components - this network contains the AGC assembly, IRIG B decoder, scan logic and sync mode logic. Its primary purpose is to condition the incoming code signal, extract the essential code elements, and load the major time counter with the translated time value. The error frame bypass feature is also controlled by this logic.

3.3.1 Time Code Generation

Time code generation is performed by the IRIG B encoder and its associated modulator. The encoder consists of a two-level multiplexer and a series of ancillary gates. These elements employ the contents of the minor and major time counters to formulate the code format and to insert the appropriate time information. The encoder produces a dc-level shift version of the code, which is applied to both the modulator and an output connector. The modulator uses a 1-kHz sine wave to modulate the code signal, which is also routed to an output connector.

Basic timing information is accumulated by the minor and major time counters. The minor time counter is clocked by a crystal controlled oscillator, and accumulates hundredths-of-milliseconds through tenths-of-seconds. The major time counter (clocked by a 1-pps signal from the minor time counter) accumulates units-of-seconds through hundredths-of-days. In addition, the major time counter is loaded with an initial value when the operator presets the start time before initiating code generation.

Selection of the generate mode is controlled by the mode control logic in conjunction with the switch and control network. All time information appearing on the LED display is produced by the major time counter.

3.3.2 Time Code Translation

Translation of an incoming IRIG B signal begins in the AGC assemlby, which normalizes the amplitude and derives clocking pulses from the 1-kHz code carrier. The IRIG B decoder employs the information from the AGC to reconstruct the dc envelope of the code and to extract the position identifier and binary 1 components. Binary 1 information (termed BIN 1) is routed to the mode control logic, where it is converted to four lines of parallel data for use in updating the major time counter.

Time is accumulated by the minor and major time counters, which are initially clocked by a 1-kHz signal derived from the IRIG B carrier. The time value appearing on the LED display and at optional rear panel connectors reflects the contents of only the major time counter. Depending on the selected operating mode, this counter is updated at various intervals to reflect the time value represented by the incoming code. Counter updating is controlled by the sync mode logic, which implements the error frme bypass feature. This logic compares data from the IRIG B Encoder and Decoder networks. If one or more errors are detected, the scan logic is directed to strobe the time value from the input code into the major time counter as required by the error frame bypass mode.

3.4 LOGIC DESCRIPTION

The following text includes a detailed description of the Model 9300 TCG/T. Supporting illustrations will consist primarily of the engineering drawings in Section Six.

3.4.1 ACG Assembly (1)

The automatic gain control (AGC) assembly contains a wide-band input amplifier and the code strippers which normalize the incoming time code signal and derive clocking signals for the decoder. The AGC amplifier is designed for a 100-millivolt to 10-volt dynamic range and a frequency response of 10 Hz to 300kHz; no adjustments are required.

After the input signal is normalized by the AGC, preset level comparators develop clock signals for decoding. The ØA clocking pulse, which occurs at the positive zero-axis crossing of the carrier, is used throughout the unit for clocking and synchronization. The ØC signal is the mark clock which occurs only each half-cycle of the carrier modulation (mark amplitude cycles).

Figure 3-2 shows two cycles of a typical modulated signal. Examples of the ØA and ØC clocks are shown relative to the signal.

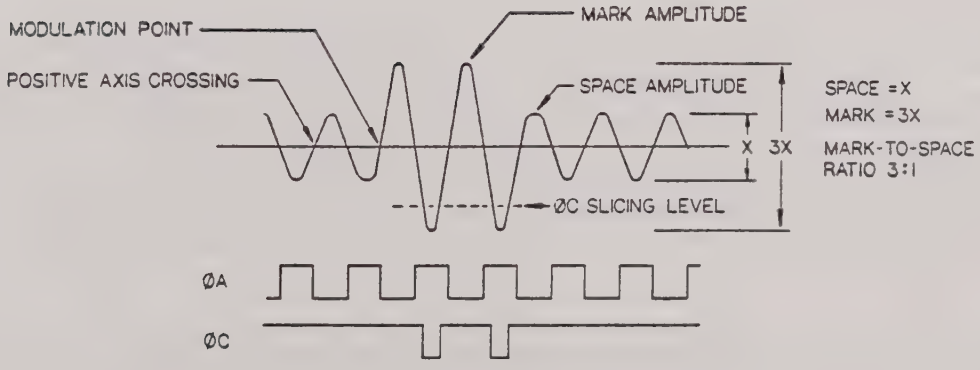


Figure 3-2. AGC Timing

3.4.2 Decoder (2)

This logic network employs the ØA, ØB and ØC clocking signals from the AGC assembly (1) to reconstruct the dc envelope of the input code. The reconstructed envelope is termed DF3. When four or more mark cycles are counted, BIN1 goes high to signify a binary one in the code. When eight mark cycles are counted, term PIC (position identifier count) goes high. Since PIC is now true, the PID (position identifier detector) flip-flop will set the next time DF3 goes low, signifying the detection of a position identifier in the IRIG B format.

Once per frame, terms PIC, PID and DF2 coincide. This occurs at plus nine milliseconds in the IRIG B format, and the decoded triggers the frame sync one-shot (FS). The resulting FS pulse sets the minor time counter (8) to a count of nine. Thus, the minor time counter is synchronized with the incoming time code.

3.4.3 Mode Control (3)

This logic network programs the unit for generate or translate mode, forward or reverse translation, and normal or inverted input code polarity.

During generate mode, the unit is automatically programmed for forward operation. In the translate mode, forward or reverse translation is controlled by the FWD/REV switch, or by the FWD* control signal if the optional parallel outputs are installed. A front panel switch conditions the 9300 to accept normal (+) or inverted (-) polarity input codes.

The mode control logic also contains a four-bit serial-to-parallel converter which converts the serial time information (BIN1) from the decoder (2) to four lines of parallel data (SF1, 2, 4, 8) in the translate mode. During generate mode, the contents of the PRESET switch are passed directly through. These outputs are applied to the D inputs of the major time counters (9), thereby permitting the start time to be preset during hold mode, and the time value to be loaded during translate mode.

Also contained in this logic network is a multiplexer which selects the clocking signals for the serial-to-parallel converter (SFS) and the milliseconds counter (CmSC*), as well as two synchronization pulses for the generate and translate modes. The serial-to-parallel converter is clocked by the 1-MHz clock (MCC) in the generate mode, and by a term from the decoder (2) in the translate mode. The milliseconds counter is clocked by tmSC8 when generate mode is selected, and by ØZ* during the translate mode. Minor time counter synchronization is performed by the GEN* flip-flop when the TCG/T is switched from Translate to Generate mode. The CmSC clock can be produced by the multiplexer only after this flip-flop is clocked by tmSC8 after Generate mode is selected (GEN·/tmSC8).

Portions of logic elements C3, D3, D9 and F9 are cross-gated to form the RUN/HOLD latch. In the generate mode, setting the MODE switch to HOLD position causes term *HOLD to go low. The halts and resets the minor time counter (8) and enables major time preset pushbuttons via term $\overline{\text{PSE}}$.

An exclusive-or element (D8 pins 1, 2, and 3) permits a low-pass filter in the AGC to be activated by either the front panel FILTER IN/OUT switch (1FSC) or by a control signal (termed $\overline{\text{SEARCH}}$) associated with the optional parallel output feature.

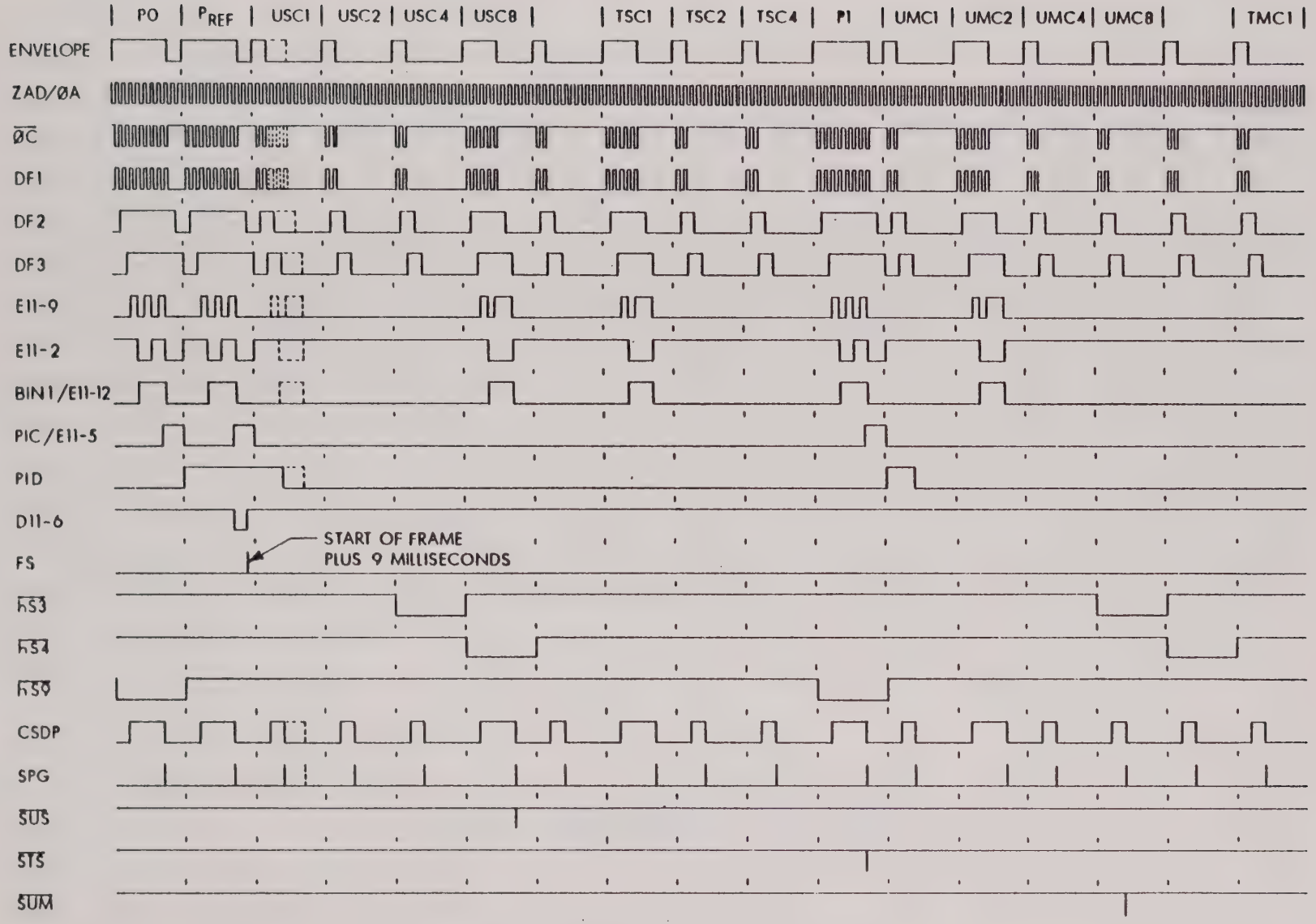


Figure 3-3. Decoder/Sync Mode Logic Timing
(sheet 1 of 2)

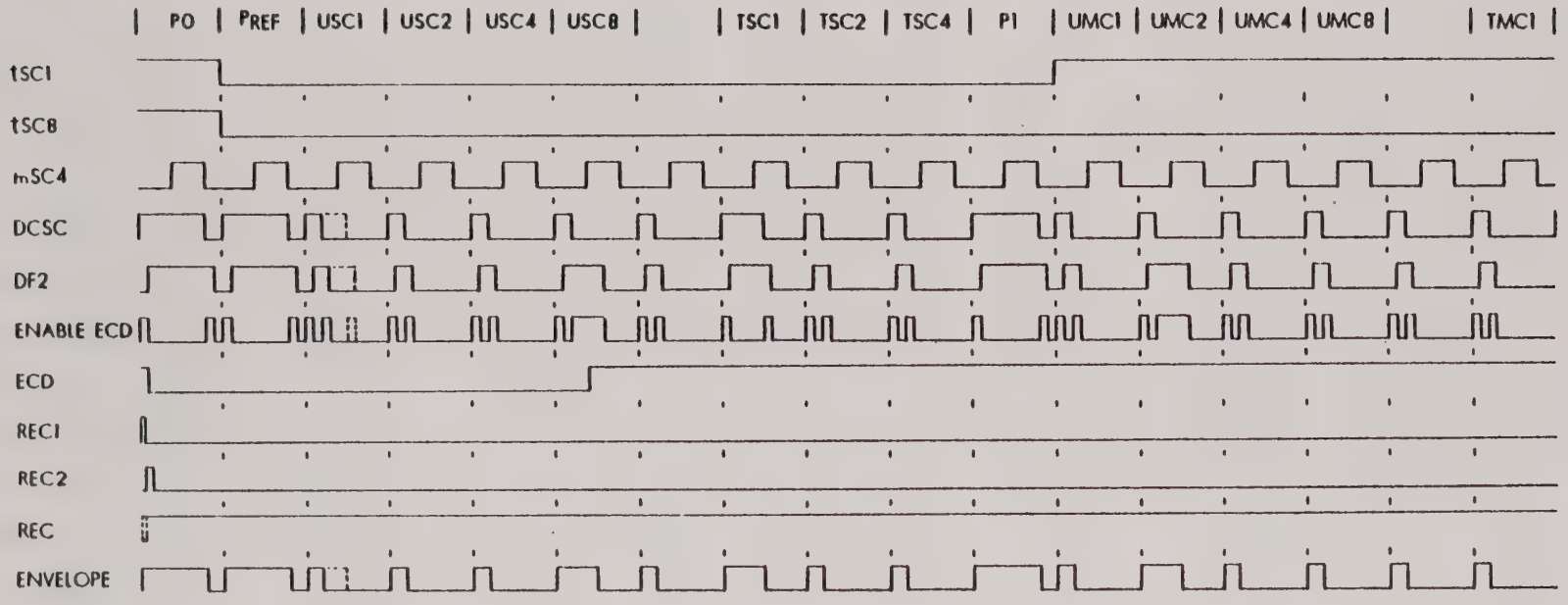


Figure 3-3. Decoder/Sync Mode Logic Timing
(sheet 2 of 2)

3.4.4 Scan Logic (4)

This network generates the load pulses which strobe the parallel data from the serial-to-parallel converter (3) into the major time counter (9).

Assignment to the proper group (seconds, minutes, hours or days) is accomplished by logic elements C5 and C7. Assignment to the proper portion of each group is accomplished by elements E6, and E7, which generate units data strobe pulses (UDSF, UDSR) and tens data strobe pulses (TDSF, TDSR) for both forward and reverse operation.

Forward or reverse strobes are selected by logic element D7. The two load pulses are factored by one-shot SPG, which limits the strobe pulses ($\overline{SPA}$ and $\overline{SPB}$) to a duration of approximately one microsecond. Term $\overline{SPG}$ inhibits the strobes in the generate mode or until the selected number of errored frames ($\overline{EC8}$) from sync mode logic (5) are counted during translate mode.

3.4.5 Sync Logic (5)

This logic serves as a digital filter to prevent erroneous information from being displayed or from disturbing the various outputs. The network is not used during code generation, or when reverse translation is selected.

The output of the IRIG encoder (/DCSC) (32) is serially compared with the decoder output. ($\overline{DF2}$). If a discrepancy exists between the two, the error detector flip-flop (ECD) will set. When ECD is reset at the end of the frame, error counter element C10 is clocked one time. The setting of the MODE-BYPASS switch (1, 2, 4, 8, oo) determines how many errored frames will be counted before counter output EC8 goes true. When this occurs, the error counter clocks are inhibited and the scan logic is enabled, allowing the input data to be loaded into the major time counter and the minor time counter to be re-synchronized by term $\overline{GFS}$.

If a valid frame is detected before the selected number of errored frames is detected, the error counter is reset by term $\overline{REC}$. Thus, synchronization will not be disturbed until the selected number of errored frames has been counted.

With the MODE/BYPASS switch in the TRANS position, EC8 is held true continuously and the unit is synchronized each frame. With oo selected, the unit is never synchronized to the incoming code and acts as a generator, using the input code carrier as a time base.

3.4.6 Time Base Logic (7)

This logic provides the 1-MHz time base for the generator. Four time bases are available for the 9300 TCT/G: two 1-MHz crystal oscillators, a 10-MHz crystal oscillator and a divide-by-ten element, or an external 1-MHz sine-wave input with a level converter. The output is a TTL 1-MHz pulse (MCC).

3.4.7 Minor Time Counter (8)

The minor time counter comprises of a series of decade counting units (DCU's) which divide the 1-MHz clock to 100 KPPS (usec8), 10 KPPS (hmsc8), 1 KKPS (tmsc8), 100 PPS (msc8), 10 PPS (hsc8), and 1 PPS (tsc8). The /HOLD term prevents the counter from updating and holds each decade reset during hold mode. Also contained on this logic are four buffers which isolate the four standard pulse rate outputs. A timing diagram is shown in Figure 3-4.

3.4.8 Major Time Counter (9)

The Major Time Counter consists of a series of up/down counters which accumulate units-of-seconds through hundreds-of-days information (see Figure 3-5). Radix control for each counter segment is performed by a separate one-shot element in the following manner:

One-Shot	Function
RTS	Resets seconds counters at 60 seconds.
RTM	Resets minutes counters at 60 minutes.
RHC	Resets hours counters at 24 hours.

The counters can be set to a predetermined time value during either the hold or translate mode. In hold mode the operator loads an initial start time by pressing the pushbutton switch beneath each digit in the LED display. Each switch applies a logic 0 to pin 11 of its respective counter segment, and the value represented by preset lines SF1 through SF8 is loaded. In translate mode, loading is controlled by strobe pulses from the Scan Logic rather than pushbuttons.

3.4.9 Display Drivers

This logic consists of a series of four-to-seven line decoders, and converts the four-line BCD output of the major time counter (9) to the seven-line format required by the L.E.D. Display (12).

3.4.10 IRIG B Encoder (32 & 32A)

This logic network employs terms from the minor and major time counters to produce dc-level-shift and modulated versions of the IRIG B time code. The elements of the encoder are shown on drawing (32), and the modulator is shown on drawing (32A).

Basically, the encoder consists of primary and subordinate multiplexers (MUX's), and a series of ancillary gating elements. The primary MUX scans the outputs of the major time counter in a sequence established by terms hSC1 through hSC8 (from the minor timer counter), which are simultaneously applied to the address inputs of each MUX element (A10 - A14). As a result of the scanning process, the MUX ouput lines (X0 through X4) reflect the following serial time information:

MUX LINE	DATA
X0	Units and tens of seconds
X1	Units and tens of minutes
X2	Units and tens of hours
X3	Units and tens of days
X4	Hundreds of days

The subordinate MUX (A15) scans the X0 through X4 lines in the sequence determined by terms tSC1 through tSC8, producing a serial representation of the time-of-year at its output ($\overline{D}$).

The remaining elements on drawing (32) control the DCSC flip-flop (A7) to produce a dc-level-shift version of the IRIG B code. The DCSC flip-flop is enabled at a 100-pps rate and clocked true by the CZC* pulse (1000 pps) at A7-12. Resetting occurs when à CZC*

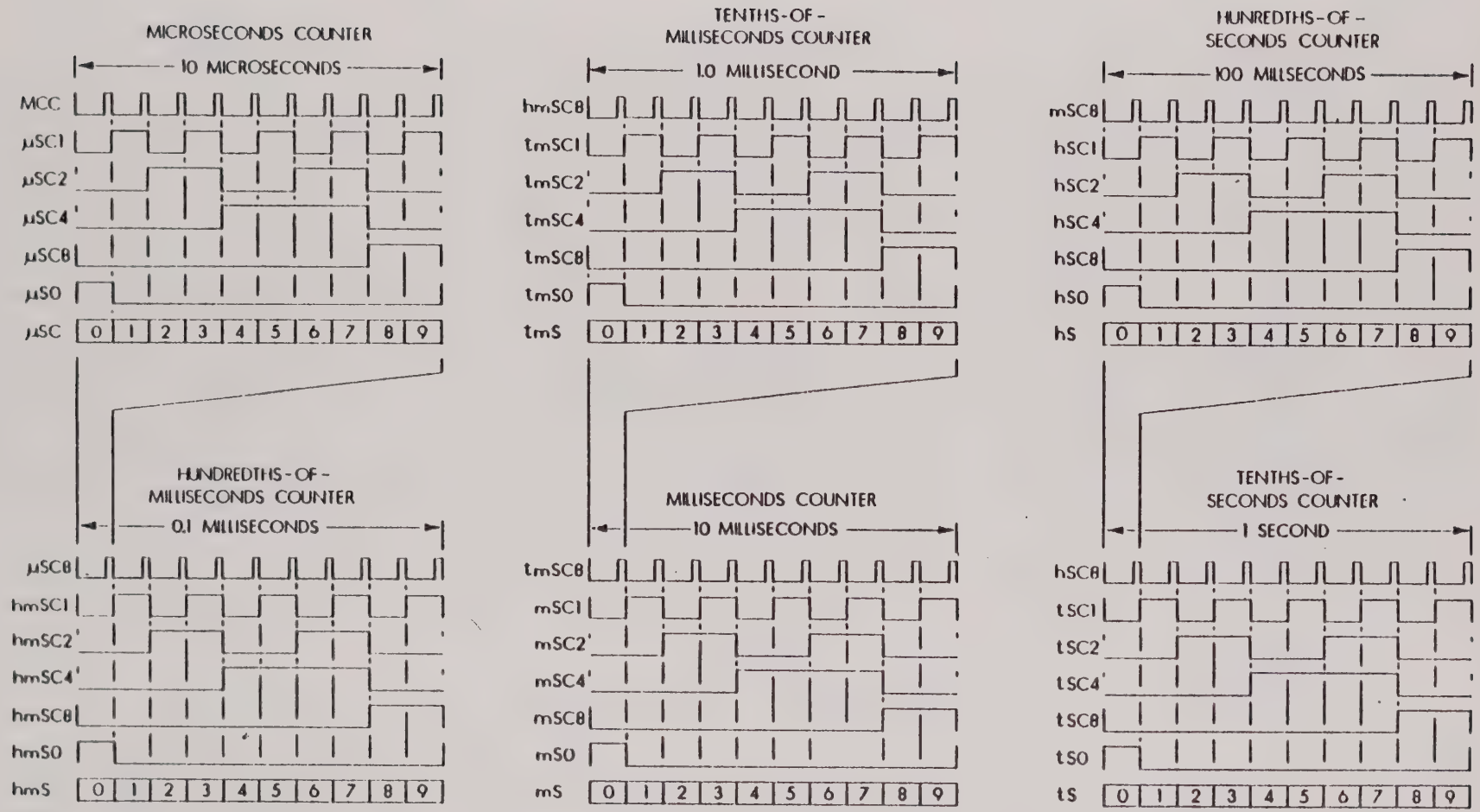


Figure 3-4. Minor Time Counter Timing Diagram

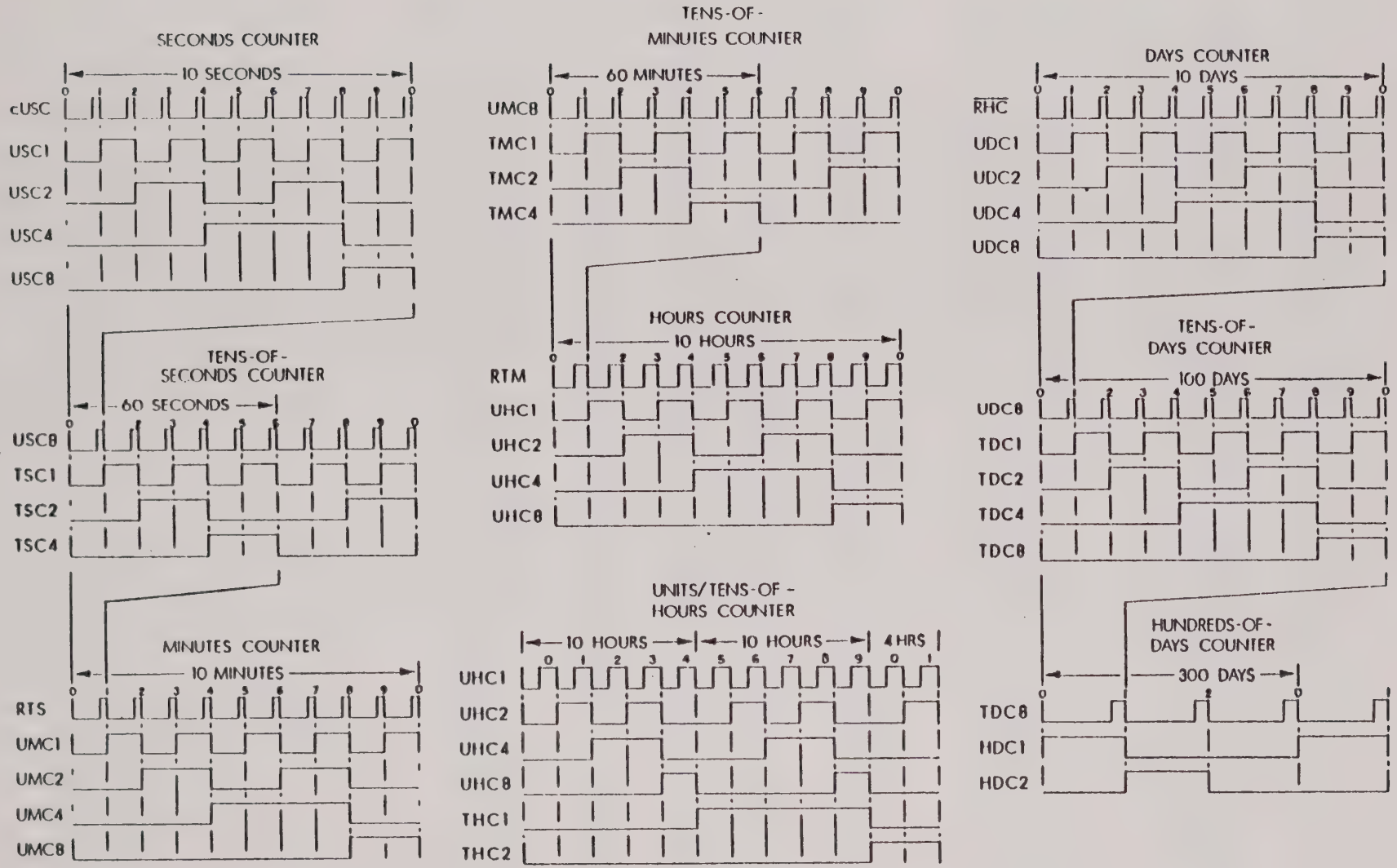


Figure 3-5. Major Time Counter, Timing Diagram

pulse occurs while the level at A7-4 is true. This occurs at two milliseconds as long as a binary 1 or a position identifier is not present. Resetting occurs at the count of five (five milliseconds if a binary 1 is present in the serial time information.

At a 10-pps rate, and at a count of 9, the DCSC reset enable is delayed for 8 counts, thus generating an 8 millisecond-wide position identifier. Once per second, at T-zero time, A7 pin 5 (XOYO) is set true. This generates the frame reference pulse of the IRIG B time code and prevents the first pulse of each frame period from being reset until a count of 8 milliseconds. The output of DCSC is buffered and presented as the DC shift code output.

On (32A) the output of A8 pin 6 is a 1KHz squarewave. The odd harmonics are filtered from the squarewave to generate a sinewave that is modulated by the DC code envelope ($\overline{\text{DSCS}}$) by means of FET Q1 and IC A17. The output of A17, pin 1, is attenuated by a potentiometer, R17, which is used to set the level of the IRIG B modulated serial time code. The output amplifier consists of A17, Q2, and Q3. The gain is set by resistors R18 and R20 and is set to be a fixed gain of 10. The modulated output is available on E6.

3.4.11 Power Supply (49)

The Power Supply furnishes regulated ±15V DC and +5V DC to the unit. The ±15V DC regulators are integrated circuit regulators with internal fault protection. The +5V DC regulator employs a LM305 voltage regulator and is of the switching type.

The LM305 is essentially an operational amplifier with built-in Zener reference. When the voltage on pin 6 falls a few millivolts below that of the internal reference, Q1 and Q2 are turned on and the voltage on the 5-volt line begins to rise. Q1 and Q2 turn off as the voltage on A1-6 rises above the reference level. L1 tries to maintain constant current flow and current begins to flow through CR2. This continues until Q1 and Q2 are again turned on and the cycle is repeated.

The switching regulator is thus an efficient method of obtaining constant 5V DC from an unregulated source, since power is dissipated in Q1 only when it is either on, or changing states.

For 5 volts from a 23V source, Q1 is on approximately 25 percent of the time. Transistors Q3 and Q4 provide short circuit protection by forcing the regulator to decrease the output voltage when the current through R7 becomes excessive. When the output voltage becomes too high, CR5 conducts and CR6 is turned on. The current limit circuit then shuts down the regulator.

3.5 GLOSSARY OF LOGIC TERMS

Table 3-1 lists the origins and general functions of the logic signals in the basic 9300 TCG/T.

Table 3-1. Glossary Of Logic Terms

Term	Origin	Function
AC CODE	(32A)	IRIG B encoder output - 1-kH_2 modulated.
AGCF	(3)	AGC filter select.
AGCP	(3) & (1)	Signal inversion control input for AGC.
BIN1	(2)	Binary 1 detect.
CBF	(5)	
CMSC	(3)	Milliseconds counter clock.
COH	(9)	Tens-of-hours counter carry output.
CSDP	(3)	Clocks SDP flip-flop at position identifier time.
ctSCD	(8)	Tenths-of-seconds counter clock (down).
ctSCU	(8)	Tenths-of-seconds counter clock (up).
cUSC	(8)	Units-of-seconds counter clock.
CUSCD	(11)	Units-of-seconds counter clock (down).
CUSCU	(11)	Units-of-seconds counter clock (up).
CZC*	(32)	1k-pps clock for DSCS flip-flop.
DC COD	(32)	IRIG B encoder output-dc envelope (buffered).
DCSC	(32)	IRIG B encoder output-dc envelope.
DF1	(2)	Decode function 1 - positive pulse occurs with each mark cycle of code carrier.
DF2	(2)	Decoder function 2 - represents dc envelope of incoming code.
DF3	(2)	Decoder function 3 - identical to DF2, but delayed by one ØA clock period.
EC1-EC8	(5)	Error frame counter outputs.
ECD	(5)	Error detect flip-flop. Compares decoder output $\overline{DF2}$ with IRIG B Encoder output $\overline{DCSC}$.

Table 3-1. Glossary Of Logic Terms (Continued)

Term	Origin	Function
ERR	(5)	Error frame detect latch.
$\overline{\text{ERROR}}$	(5)	Error frame detect latch.
FBoo	(11)	MODE select switch output. Selects infinit number of error frames for bypass.
$\overline{\text{FB1}}$-$\overline{\text{FB8}}$	(11)	MODE select switch outputs. Error frame bypass values.
$\overline{\text{FS}}$	(2)	Frame sync pulse. Synchronizes minor time counter. Occurs once per frame.
$\overline{\text{FS}}$*	(3)	
FWD	(3)	Direction control for serial-to-parallel counter.
$\overline{\text{GEN}}$	(11)	MODE select switch output. Selects generate mode.
GEN*	(3)	Synchronizes minor time counter when unit is switched from translate to generate mode.
$\overline{\text{GFS}}$	(5)	Synchronizes minor time counter.
$\overline{\text{GFS}}$*	(3)	
GO	(11)	Tape search control term (optional).
$\overline{\text{HOLD}}$	(3)	Hold control latch output.
$\overline{\text{HOLD}}$*	(11)	MODE select switch output. Selects hold mode.
hSC1-hSC8	(8)	Hundredths-of-seconds counter outputs.
IFSC	(11)	Filter-select switch output.
INV	(11)	Polarity switch output.
mSC1-mSC8	(8)	Milliseconds counter outputs.
PIC	(2)	Position identifier count.
PID	(2)	Position identifier detect flip-flop.
$\overline{\text{PSE}}$	(3)	Buffered version of $\overline{\text{HOLD}}$.
$\overline{\text{READ}}$	(11)	MODE select switch output. Selects read mode.
$\overline{\text{REC}}$	(5)	Error counter reset. Resets counter if valid frame is detected before preselected number of error frames occurs.

Table 3-1. Glossary Of Logic Terms (Continued)

Term	Origin	Function
REV	(11)	Code direction switch output.
RHC	(9)	Days counter clock - 24-hour radix.
RTM	(9)	Hours counter clock - 60-seconds radix.
RTS	(9)	Minutes counter clock - 60-seconds radix.
SDP	(4)	Triggers SPG one-shot.
SF1-SF8	(3)	Serial-to-parallel converter outputs.
SF1-SF8*	(11)	PRESET thumbwheel switch outputs.
SFS	(3)	Serial-to-parallel converter clock.
$\overline{\text{SHD}}$	(4) & (11)	Hundreds-of-days counter preset control.
$\overline{\text{SPA}}$	(4)	Scan pulse-units data.
$\overline{\text{SPB}}$	(4)	Scan pulse-tens data.
SPG	(4)	Scan pulse generator output. Defines duration of preset control pulses for major time counter.
$\overline{\text{SPG}}$	(4)	Inhibits scan pulse during GEN mode or until selected number of error frames is detected during TRANS mode.
$\overline{\text{START}}$	(11)	START pushbutton switch output.
$\overline{\text{STD}}$	(4)	Tens-of-days counter preset control.
$\overline{\text{STH}}$	(4) & (11)	Tens-of-hours counter preset control.
$\overline{\text{STM}}$	(4) & (11)	Tens-of-minutes counter preset control.
$\overline{\text{STS}}$	(4) & (11)	Tens-of-seconds counter preset control.
$\overline{\text{SUD}}$	(4) & (11)	Units-of-days counter preset control.
$\overline{\text{SUH}}$	(4) & (11)	Units-of-hours counter preset control.
$\overline{\text{SUM}}$	(4) & (11)	Units-of-minutes counter preset control.
$\overline{\text{SUS}}$	(4) & (11)	Units-of-seconds counter preset control.
TDSF	(4)	Tens data scan pulse (forward)
TDSR	(4)	Tens data scan pulse (reverse)

Table 3-1. Glossary Of Logic Terms (Continued)

Term	Origin	Function
THC1-THC2	(9)	Tens-of-hours counter outputs.
TMC1-TMC4	(9)	Tens-of-minutes counter outputs.
TSC1-TSC4	(9)	Tens-of-seconds counter outputs.
tSC1-tSC8	(8)	Tenths-of-seconds counter outputs.
tSC8B	(32)	Buffered version of tSC8.
UDSF	(4)	Units data scan pulse (Forward).
UDSR	(4)	Units data scan pulse (Reverse).
UHC1-UHC8	(9)	Units-of-hours counter outputs.
UMC1-UMC8	(9)	Units-of-minutes counter outputs.
USC1-USC8	(9)	Units-of-seconds counter outputs.
X0 - X5	(32)	IRIG B encoder multiplexer outputs.
ØA/ZAD	(1) & (11)	AGC output square wave derived from carrier of incoming modulated time code signal.
ØB	(1)	Inverted version of ØA.
ØC	(1)	AGC peak detector output.
ØA*	(2)	Decoder clock derived from ØA output of AGC.
ØB*	(2)	Inverted version of ØA* - decoder clock.
MCC	(7)	Primary clocking pulse rate (from internal or external source).
100PPS	(8)	100-pps pulse rate derived from mSC8*.
10PPS	(8)	10-pps pulse rate derived from hSC8*.
1PPS	(8)	1-pps pulse rate derived from tSC8*.
1KHZ SINE	(32A)	IRIG B encoder output - 1kHz sine wave derived from minor time counter.
1KPPS	(8)	1k-pps pulse rate derived from CmSC*.
1MHZ	(7)	1MHz clocking oscillator output (optional).

SECTION FOUR

ADJUSTMENTS

4.1 INTRODUCTION

This section describes the adjustment potentiometers in the basic 9300 TCG/T. Adjustments relating to optional features are described in Appendix A.

NOTE

Values shown in parenthesis indicate nominal settings used at the factory.

4.2 SINEWAVE SHAPER/MODULATED ASSEMBLY

1. Level adjustment - potentiometer R17. Range is 0-to-10 Vpp on the mark amplitude of the output code (3.0 Vpp nominal).

2. Modulation ratio adjustment - potentiometer R15. Range is 2:1 to 4:1 mark-to-space ratio the output code (3:1 nominal).

3. Phase adjustment - potentiometer R7. Sets the phase of the carrier frequency to ensure continuity when amplitude modulation takes place.

4.3 POWER SUPPLY ASSEMBLY

Potentiometer R10 is used to adjust the output level of the +5-volt regulator. The level should be +5V $\pm$2%.

SECTION FIVE

MAINTENANCE

5.1 GENERAL

The Model 9300 TCG/T utilizes solid-state components. There are no moving parts or parts with limited life. No periodic maintenance is required if the unit is used under normal conditions. If the instrument is exposed to unusual operating conditions, such as high dust or high humidity environments, or is dropped or otherwise damaged, it may be necessary to perform certain inspection and/or repair procedures.

WARNING

Hazardous voltage levels exist in this equipment when power is applied. Exercise extreme caution when protective covers are removed.

5.2 DRAWING STRUCTURE

The drawings contained in Section Six of this manual documents the instrument to a level that will enable an experienced maintenance technician to locate and replace any functional electronic component. Documentation for structural elements such as support brackets, attaching hardware, chassis components, etc., is not normally included.

1. Top Assembly Drawing

   This drawing defines the configuration of a specific instrument. The part numbers and physical locations of all major assemblies are shown, as well as outline dimensions of the chassis. Interface connectors are also included.

2. Schematic Drawings

   Schematic drawings of all electronic circuitry are included. The numbers shown in the title blocks of these drawings correspond to the assembly numbers itemized on the Top Assembly drawing.

   In addition to showing the electronic design of the instrument, these drawings also serve as illustrations for the theory of operation in Section Three.

3. Material Lists

   Stock numbers, characteristics, quantities and reference designators for all electronic components are contained in a series of material lists in Section Seven. A separate list is provided for each major assembly in the instrument.

5.3 LOCATING COMPONENTS

When troubleshooting, the technician typically refers to the schematic drawing of a suspected assembly. After being isolated on the schematic, a faulty component can be located by finding its reference designation on the p.c. board. The characteristics and part number of the component can be determined by referring to the material list for the appropriate assembly.

Generally, the logic symbology employed in Datum drawings conforms to industry standards for functional definitions. However, a unique system is employed to show origins and destinations of logic terms. Appropriate terms are accompanied by encircled numbers (shown in parentheses within the manual text) that specify the drawings on which the terms originate, or to which they are to be routed. The encircled numbers are shown in the title blocks of all schematic drawings.

Physical locations of components on p.c. boards are specified by reference designations (A1, A2, etc.). Two basic methods of reference designator organization are employed in Datum equipment: sequential and cross-grid. When arranged sequentially, the components are placed on the boards in numerical sequence and the associated reference designators are etched on the board. The cross-grid method employs vertical columns arranged alphabetically, and horizontal columns in numerical sequence; components are referenced according to their coordinates.

5.4 INSPECTION

If it is necessary to inspect the unit, the following should be considered:

1. Always disconnect AC power before removing the instrument cover. To remove the cover, simply remove the screw at the rear panel an slide the cover off to the rear.

2. Make a thorough visual inspection of all circuitry and wiring.

3. Check for physical integrity of all components. Look for burned or cracked components, loose physical damage, leakage of insulation compounds or general physical damage. To aid in overall maintenance and repair, each integrated circuit is mounted in an individual modular socket. Removal or replacement is therefore convenient and easy.

   It should rarely be necessary to replace an integrated circuit; however, if replacement is attempted, ensure that all component leads enter the socket and that no leads are bent under the component or extended out from the socket.

   Check to see that all IC's are firmly mounted in the socket so that good electrical contact is made.

4. Check all switches and connectors for loose or broken wires.

5. If the internal component surfaces and components have an excessive amount of dust deposited on them, use a soft brush and a low pressure stream of air to remove any foreign material.

CAUTION

Do not clean PC boards or small internal components with a stiff brush or solvents since damage to the circuits may result. A high powered vacuum cleaner device should not be used on small internal components.

6. Wipe the external surfaces of the instrument with a soft damp cloth to remove dirt, fingerprints and other foreign material.

7. Replace the cover and reconnect the AC power and input connector. Check operation. If performance does not match or exceed the specifications listed, corrective maintenance is in order.

5.5 PRINTED CIRCUIT BOARD REPAIR

Removal and insertion of IC components can be easily made as described above. Should it be necessary to replace conventional components which are soldered to the circuit board, cut the leads of the part near the lead holes. Using a low-power (50 watts or less) soldering iron, apply heat sparingly to each cut lead. As soon as the solder melts, slip the lead from the hole and clean the hole with a tooth pick. Clean the board surfaces with isopropyl alcohol. Form the tinned leads of the replacement part and insert in cleaned holes, trimming the leads to extend 1/16-inch beyond the back surface of the board. Only 63/37 solder with a maximum diameter of 1/16 inch should be used. Solder the leads to the board and use a hemostat, long nosed pliers, or other heat sink on the leads of all semiconductor devices and quarter-watt resistors. Allow the soldered junction to cool before removing the heat sink.

SECTION SIX
LIST OF DRAWINGS

This section contains assembly, wiring and schematic drawings for the specific unit addressed by this manual. The encircled number in the title block of each drawing defines the sequence in which the drawing is contained herein. The encircled numbers are shown in parentheses in the following drawing list:

NOTE

A detailed description of the drawing structure is contained in the Theory of Operation

1.	Top Assembly	9300-7509
2.	AGC (1)	16085
3.	IRIG Basic (2)(3)(4)(5)(7)(8)(9)(10)	16543
4.	Switch & Control Logic (11)	9300-8999
5.	LED Display (12)	16549
6.	Group Binary Converter (27)	16737
7.	Parallel Outputs (30)	16669
8.	IRIG B Encoder (32)	16062
9.	Power Supply (49)	16280
10.	Control Function Decoder (53)(54)	17082
11.	Modification Drawing	9300-80000

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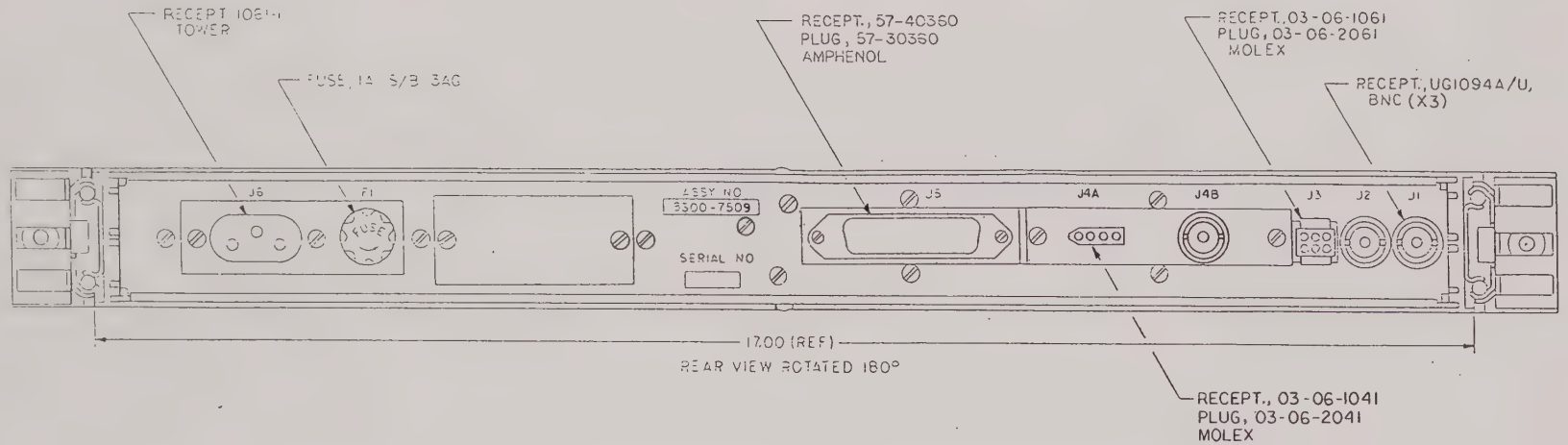
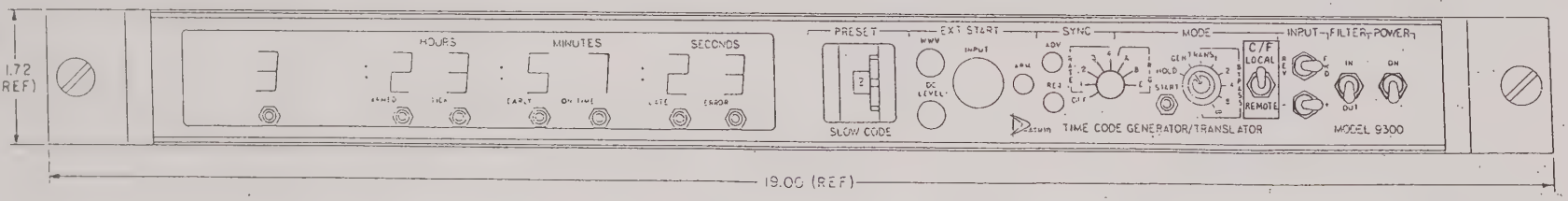




5. MODIFICATION DRAWING 9300-80000
4. SWITCH & CONTROL LOGIC 9300-8999
3. WIRE LIST 810808(UNIT)

J6-AC POWER INPUT
J5-GROUP BINARY PARALLEL OUTPUTS
J4B-IRIG B DC LEVEL SHIFT OUTPUT
J4A-CONTROL FUNCTION INPUTS
J3-PULSE RATES
J2-CODE OUTPUT } IRIG B
2. J1-CODE INPUT }
1. SLIDES & MOUNTING BRACKETS ARE OPTIONAL

NOTES UNLESS OTHERWISE SPECIFIED

THIS DATA IS CONFIDENTIAL TO DATUM, INC AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOL: .XX ± .010
ANGLES ± 1/2°

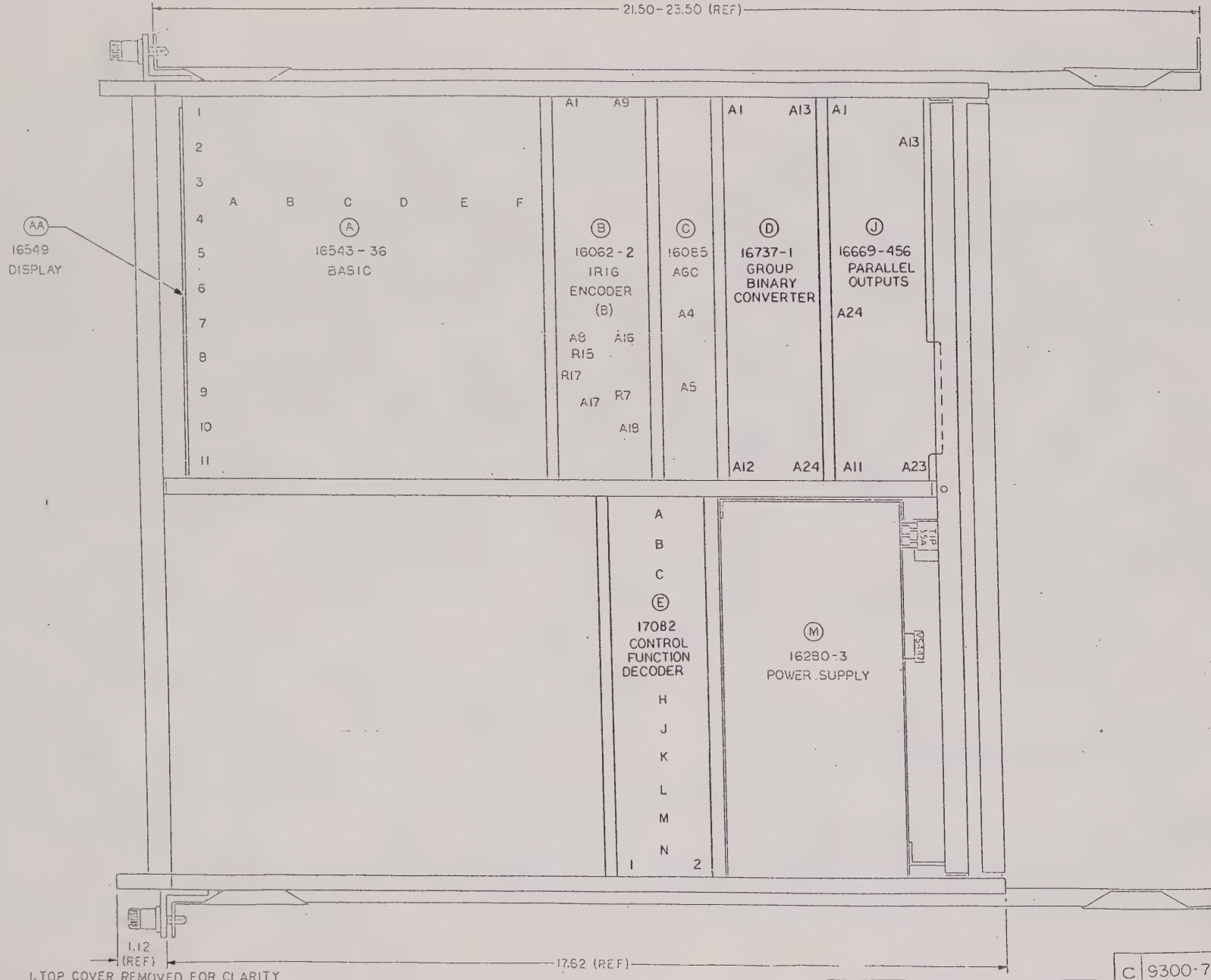
TITLE: TIME CODE GENERATOR/TRANSLATOR

Datum Inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

DWN SATINDER 8 6 87
CHK
DES
CHGR GH 8/8/87

C | 9300-7509

SCALE NONE | FSC 31160 | SIZE | SHT 1 of 2 | REV



1. TOP COVER REMOVED FOR CLARITY

NOTES: UNLESS OTHERWISE SPECIFED

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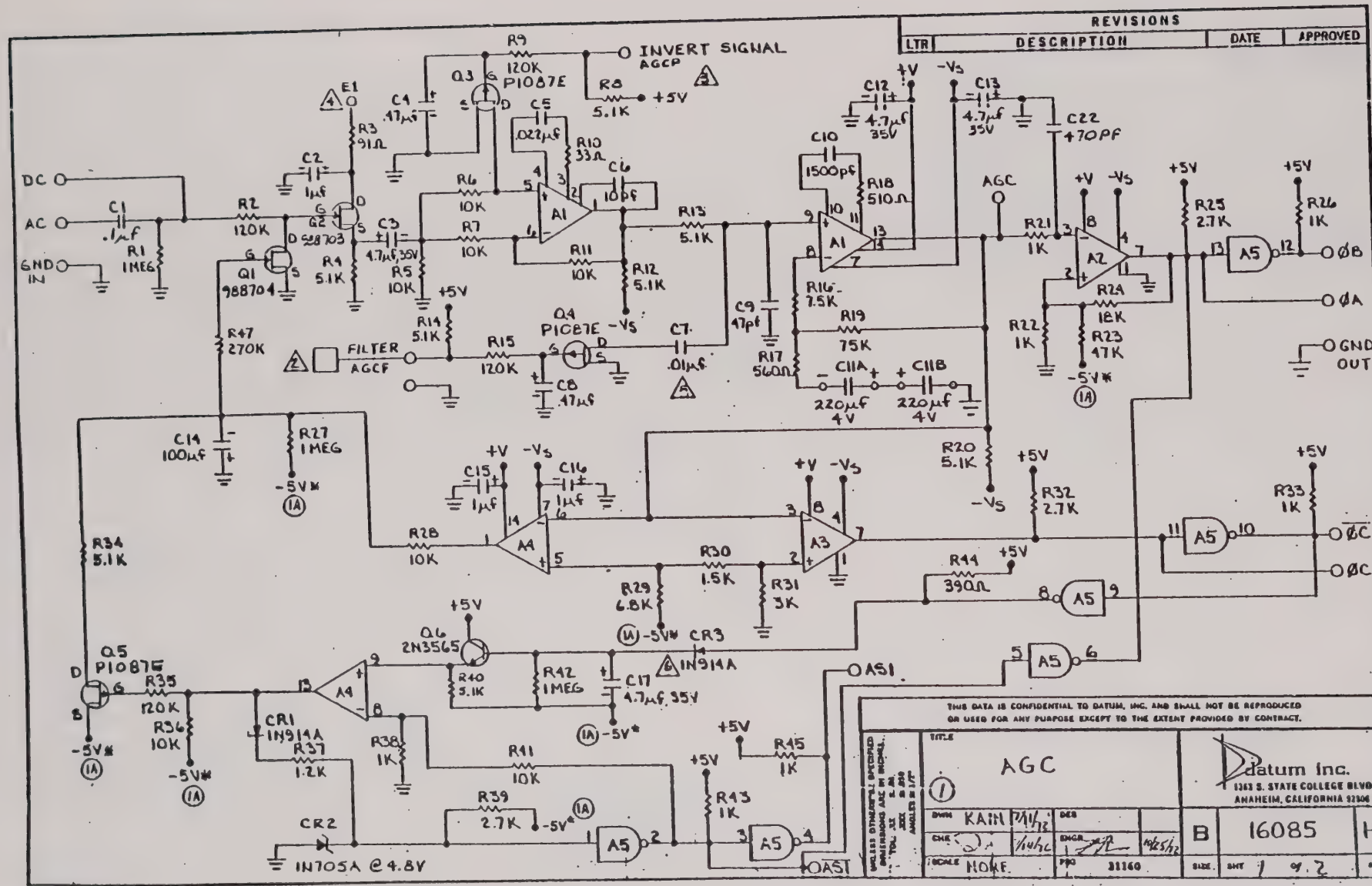
C | 9300-7509

SIZE | SHT 2 OF 2 | REV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Q6 2N3565
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A2
A3
A4
A5
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CR2 IN705A @ 4.8V
CR3 IN914A
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R2 120K
R3 91Ω
R4 5.1K
R5 10K
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R7 10K
R8 5.1K
R9 120K
R10 33Ω
R11 10K
R12 5.1K
R13 5.1K
R14 5.1K
R15 120K
R16 7.5K
R17 560Ω
R18 510Ω
R19 75K
R20 5.1K
R21 1K
R22 1K
R23 47K
R24 18K
R25 2.7K
R26 1K
R27 1MEG
R28 10K
R29 6.8K
R30 1.5K
R31 3K
R32 2.7K
R33 1K
R34 5.1K
R35 120K
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R40 5.1K
R41 10K
R42 1MEG
R43 1K
R44 390Ω
R45 1K
R47 270K
C1 .1μf
C2 1μf
C3 4.7μf 35V
C4 .47μf
C5 .022μf
C6 10pf
C7 .01μf
C8 .47μf
C9 47pf
C10 1500pf
C11A 220μf 4V
C11B 220μf 4V
C12 4.7μf 35V
C13 4.7μf 35V
C14 100μf
C15 1μf
C16 1μf
C17 4.7μf 35V
C22 470PF
THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.
TITLE
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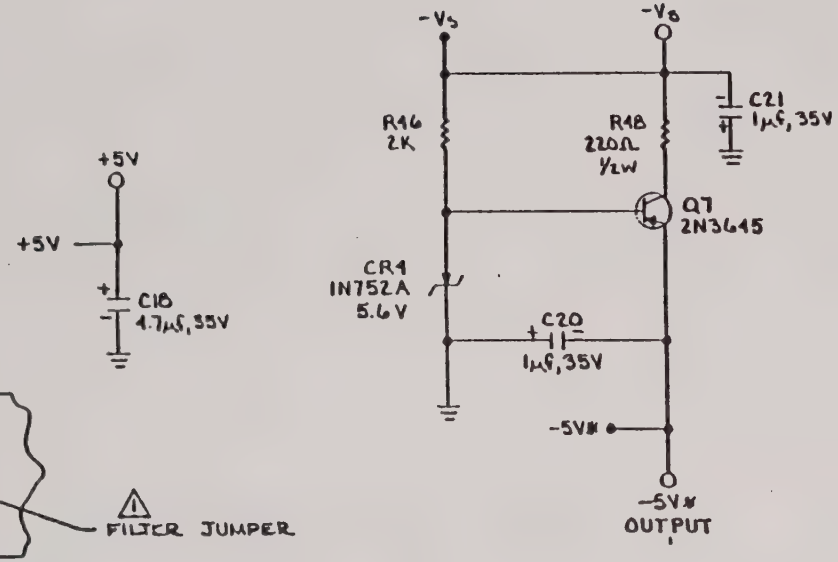
DWN KAIN 11/15/72
CHK 11/16/72
ENGR 11/25/72
SCALE NONE
PRO 31160
SIZE B
16085
REV H
SHT 1 OF 2
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	ADDED C22	5-27-72	R.F.
B	ADDED R20 TO SCHEMATIC +E WAS +V5	1-22-73	Rail
C	Q3,4,5 WERE 2N4342	6-13-73	R.J.
D	ADDED C11A & C11B	7-13-73	Rail
E	Q1 WAS 988703	9-12-73	R.J./C.N
F	C12 & C13 WERE 1μf	9-21-73	Rail/C.N
G	R3 WAS TO +E, ADDED E1	11-26-73	Rail/R.S.
H	ADDED ⑥	7-7-79	C.A.



⑥ -2 C17 IS 27μf 10V, R27 IS 4.7M

⑤ -1 C7 IS .001μf.

④ WIRE TO +15 OR +5V AS REQUIRED

③ THIS POINT GROUNDED TO INVERT SIGNAL - REVERSE MODE

② SEE PARALLEL OUTPUT SCHEM FOR PIN NUMBER

⚠1 REMOVE FOR REMOTE OR HIGHSPEED OPERATION

PART NO	MFR	REF
SN7405	NATIONAL	A5
μA749	FAIRCHILD	A1, A4
LM311H	NATIONAL	A2, A3

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOL: .XX ±.03 .XXX ±.010 ANGLES ±1/2°

TITLE: AGC (1A)

DWN KAIN 7/19/72 DES RF 7/20/72

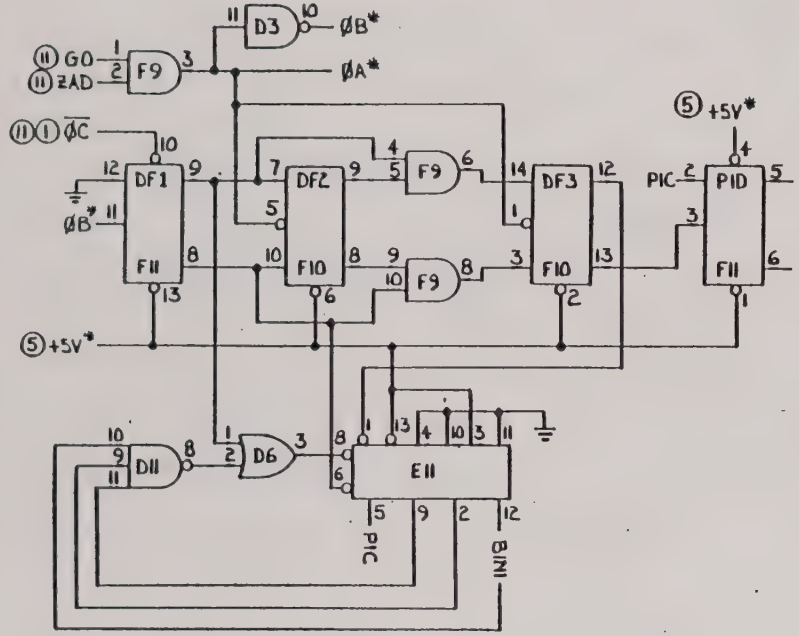
CHK [signature] 7/19/72 ENGR [signature] 7/20/72

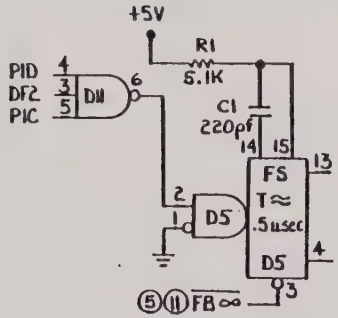
SCALE: NONE FSC 31160

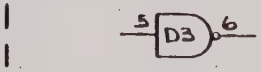
Datum Inc.
BUS & STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

SIZE B 16085 REV H

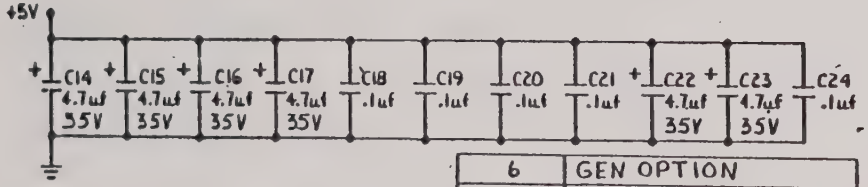
SHT 2 OF 2







NOT USED



DASH NO.	DESCRIPTION
6	GEN OPTION
5	10MHZ CRYSTAL OSC
4	CO251 OSC
3	CO231 OSC
2	EXT OSC
1	DAYS
—	BASIC S-M-H

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

PART NO	MFR	REF DES
899-1-RGK	BECKMAN	C6, C8
LM311D	NATIONAL	A1
MC12061F	MOTOROLA	D1
9374-DE	FAIRCHILD	A2-A10
SN74177N	T I	C10, E11
SN74176N	TI	E5, F4-F7, C1
N7486A	SIGNETICS	C3, D8
N7473A	↕	E10
N7442B	SIGNETICS	E6
SN7432N	T.I.	D6
N7411A	SIGNETICS	C9
N7410A	↕	D11
N7408A	↕	D9, F8, F9
N7404A	↕	D3
N7400A	SIGNETICS	D2, D10, A11
SN74156N	T.I.	C5, C7
SN7474N	↕	E9, F11
SN7425N	↕	E8
SN74194N	↕	C2
SN74192N	↕	B2-B10, E4
SN74157N	↕	C4, D7, E7
SN74123N	↕	D5, B11
SN74H106N	↕	D4
SN74H103N	T.I.	F10
SN74122N	TI	C11
PART NO	MFR	REF DES

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TITLE: IRIG BASIC (2) (DECODER)

DWN IC 6/24/74 DES

CHK [signature] 6/24/74 ENGR [signature] 12/4/73

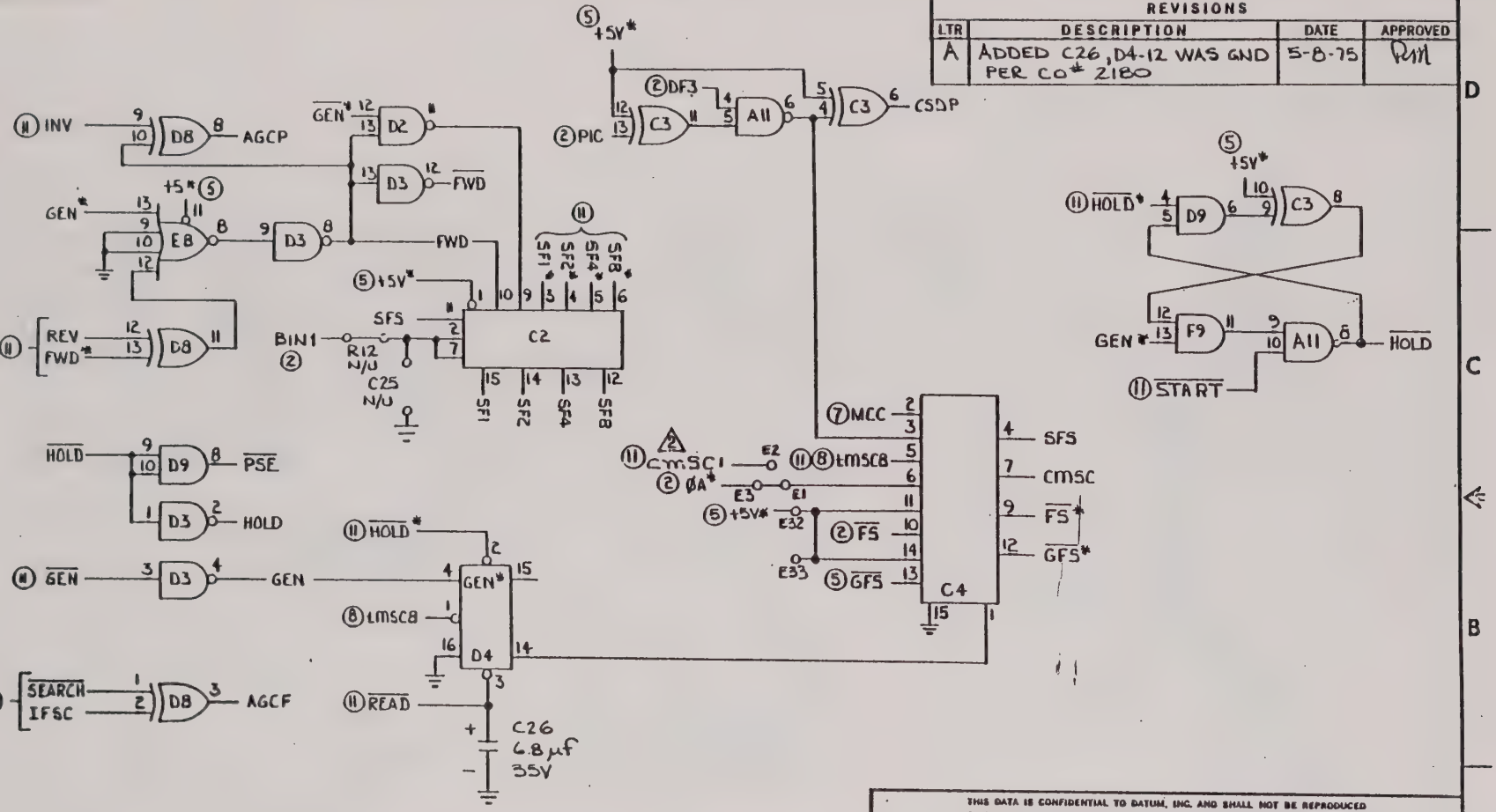
SCALE NONE FSC 31160

datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

B 16543 E

SIZE SHT 1 OF 8 REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	ADDED C26, D4-12 WAS GND PER CO# 2180	5-8-75	



⚠2 WITH SYNC GEN OPTION, REMOVE JUMPER BETWEEN E1 AND E3, JUMPER E1 TO E2.

NOTES: UNLESS OTHERWISE SPECIFIED

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL: .XX ± .010 .XXX ± .005 ANGLES ± 1/2°

TITLE: IRIG BASIC (3) (MODE CONTROL)

DWN	IC	6/20/74	DES		
CHK		6/24/74	ENGR		12/6/74
SCALE	NONE		FSC	31160	

Datum Inc.
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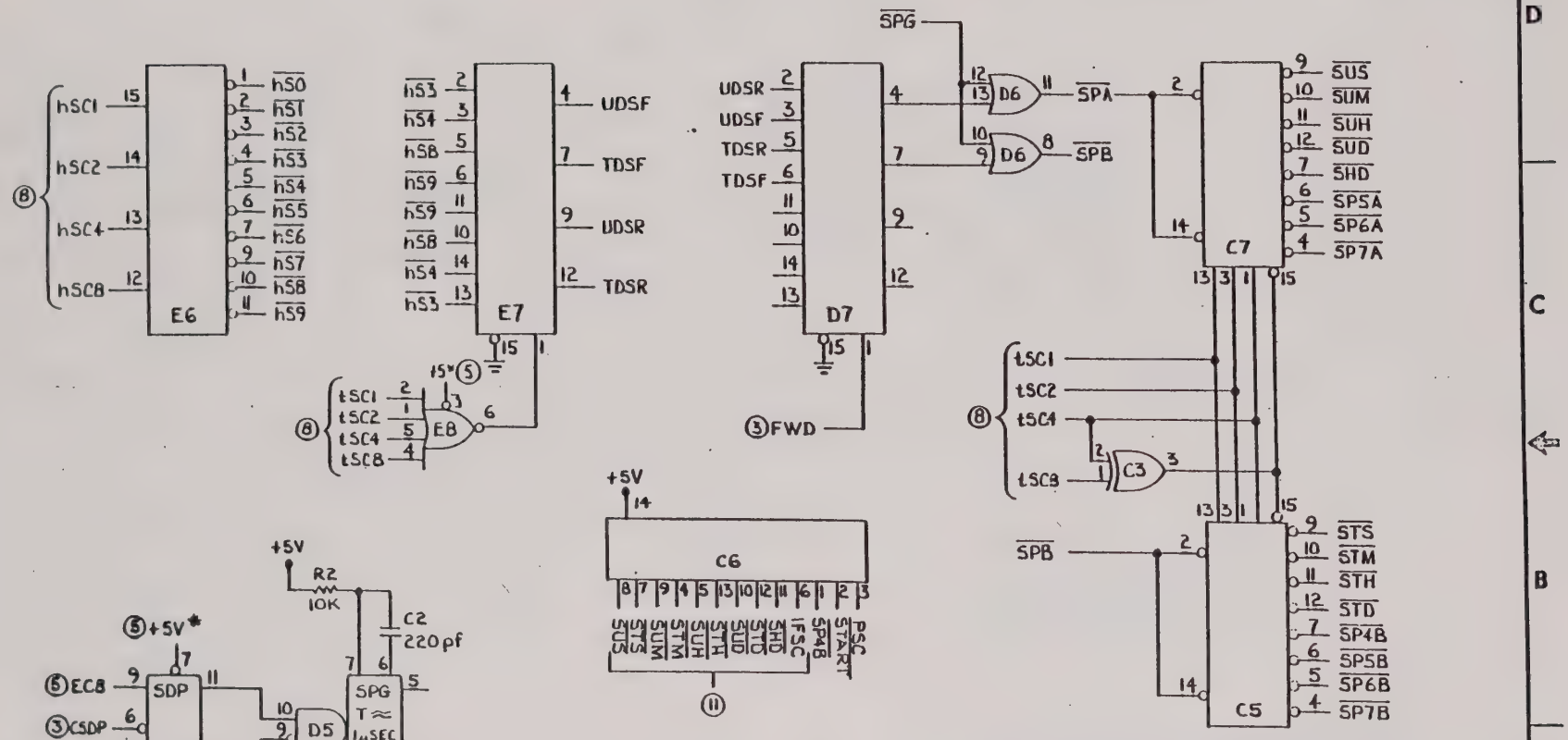
B | 16543 | E

SIZE | SHT 2 OF 8 | REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL: .XX ±.03, .XXX ±.010, ANGLES ± 1/2°

TITLE: IRIG BASIC (SCAN LOGIC) (4)

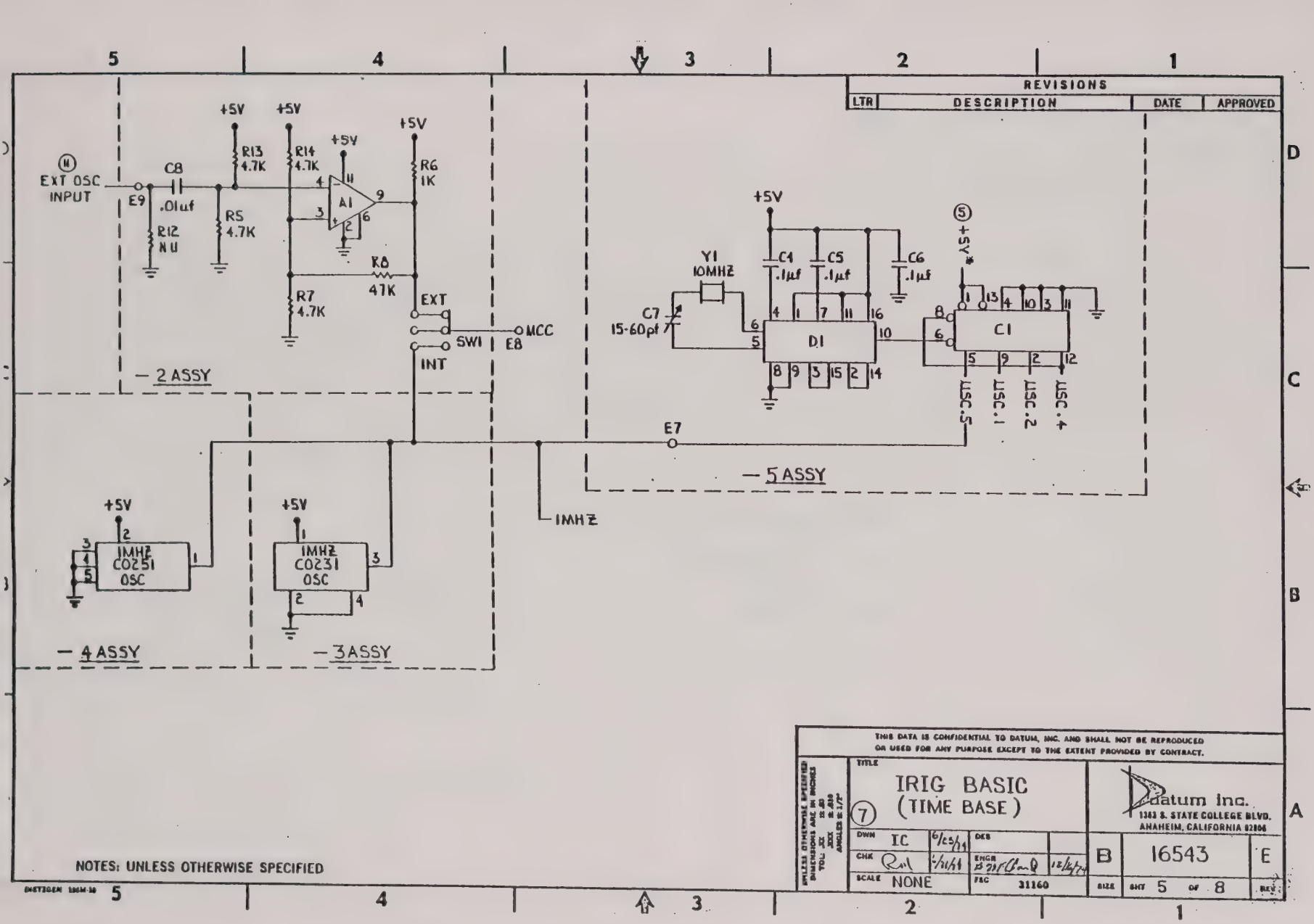
DWN IC	6/24/74	DES	
CHK [signature]	6/26/74	ENGR [signature]	12/6/74
SCALE NONE		FSC 31160	

datum Inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

B | 16543 | E

SIZE | SHT 3 OF 8 | REV

REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
1 DAYS OPTION
tSC4
tSCU
tSC2
hSC8
CBF
E9
DFZ
DCSC
D8
FWD
C9
ECD
MSC4
GEN
REC
D11
R3
150Ω
ERROR
D10
ERR
REC
REC1
READ
FB4
FB8
FB2
D9
C9
D6
EC8
C10
FB1
FB8
EC1
EC2
EC4
EC8
E6
E5
D2
FS
E4
GFS
+5V
R4
1K
+5V
C3
4.7µf
35V
REC1
E10
tSC8
REC2
FB
+5V
C8
GO SEARCH
INV REV
FWD
HOLD
GEN READ
FB8
FB4
FB2
FB1
IF DAYS OPTION IS NOT SUPPLIED:
E9-12 IS CONNECTED TO tSC2
E9-11 IS CONNECTED TO hSC8
NOTES: UNLESS OTHERWISE SPECIFIED
THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.
TITLE
IRIG BASIC
(SYNC MODE)
5
DWN IC 6/25/74
CHK 6/2/74
SCALE NONE
ENGR 10/16/74
FSC 31160
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806
B
16543
E
SIZE
SHT 4 OF 8
REV


5
4
3
2
1
D
C
B
A
REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
(4) EXT OSC INPUT
E9
C8
.01uf
R12
N U
R13
4.7K
R5
4.7K
R14
4.7K
R7
4.7K
+5V
A1
R6
1K
R8
47K
EXT
SW1
INT
E8
MCC
— 2 ASSY
Y1
10MHZ
C7
15-60pf
C4
.1µf
C5
.1µf
C6
.1µf
D1
C1
(5) +5V
USC.5
USC.1
USC.2
USC.4
E7
— 5 ASSY
1MHZ
1MHZ
CO251
OSC
1MHZ
CO231
OSC
— 4 ASSY
— 3 ASSY
NOTES: UNLESS OTHERWISE SPECIFIED
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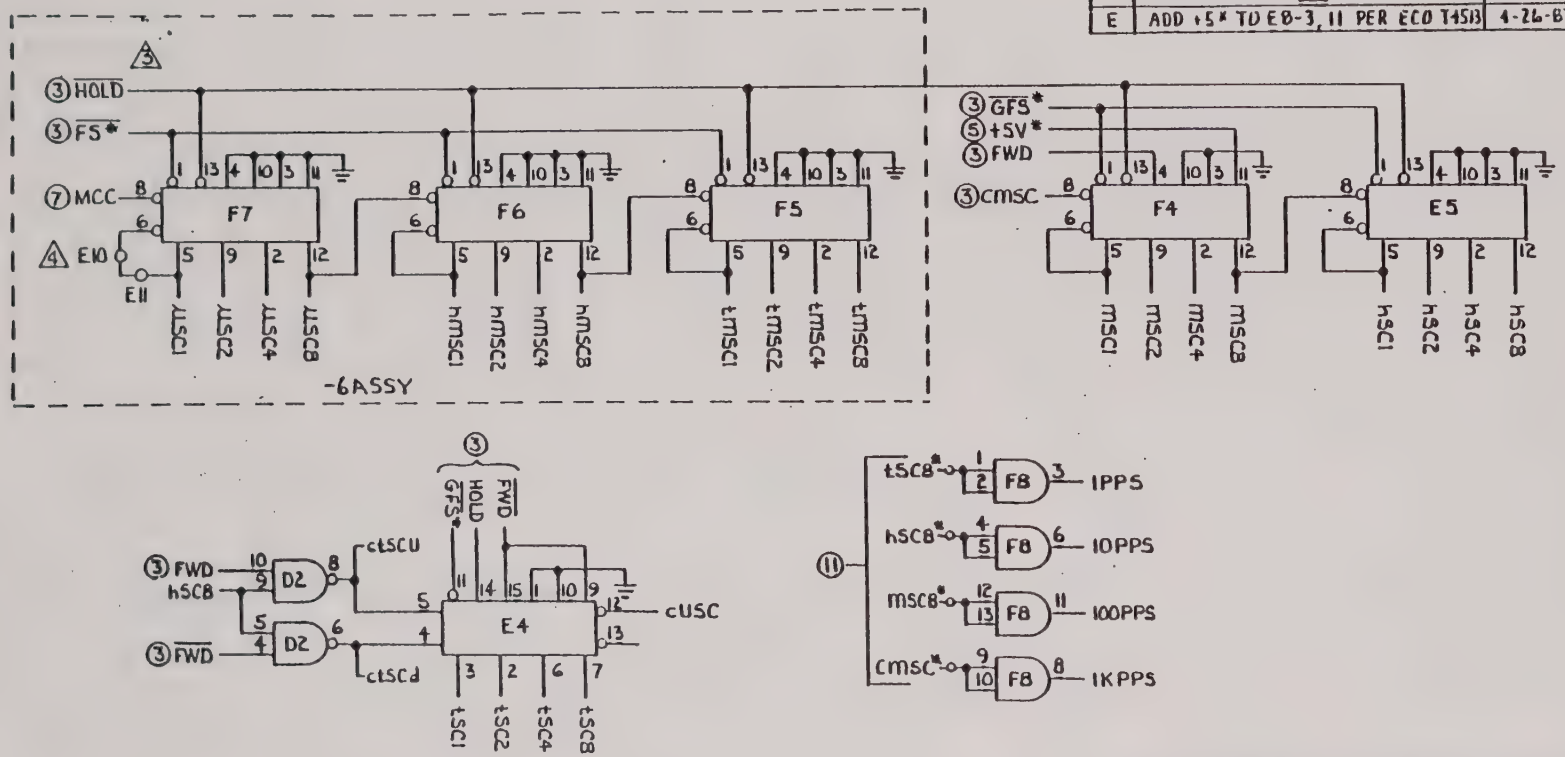
TITLE
(7) IRIG BASIC (TIME BASE)
DWN IC 6/23/71
CHK 7/11/71
SCALE NONE
DES
ENGR 12/14/71
FSC 31160
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806
B
16543
E
SIZE
SHT 5 OF 8
REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
B	C11 WAS 74123 PER CO*2277	9-9-75	Phil
C	REVISED PER C.O. 2747	6-18-76	IC
D	ADDED NOTE 4	12-10-81	T.L.
E	ADD +5* TO E8-3, 11 PER ECO T4513	4-26-82	DR



4 WHEN ADV/RET OPTION IS USED CONNECTION BETWEEN E10 & E11 IS REMOVED. E10 IS CONNECTED TO CMSC2 FROM (20)

3 WHEN SYNC GEN OPTION IS USED ALL -6 TERMS ORIGINATE ON (15)

NOTES: UNLESS OTHERWISE SPECIFIED

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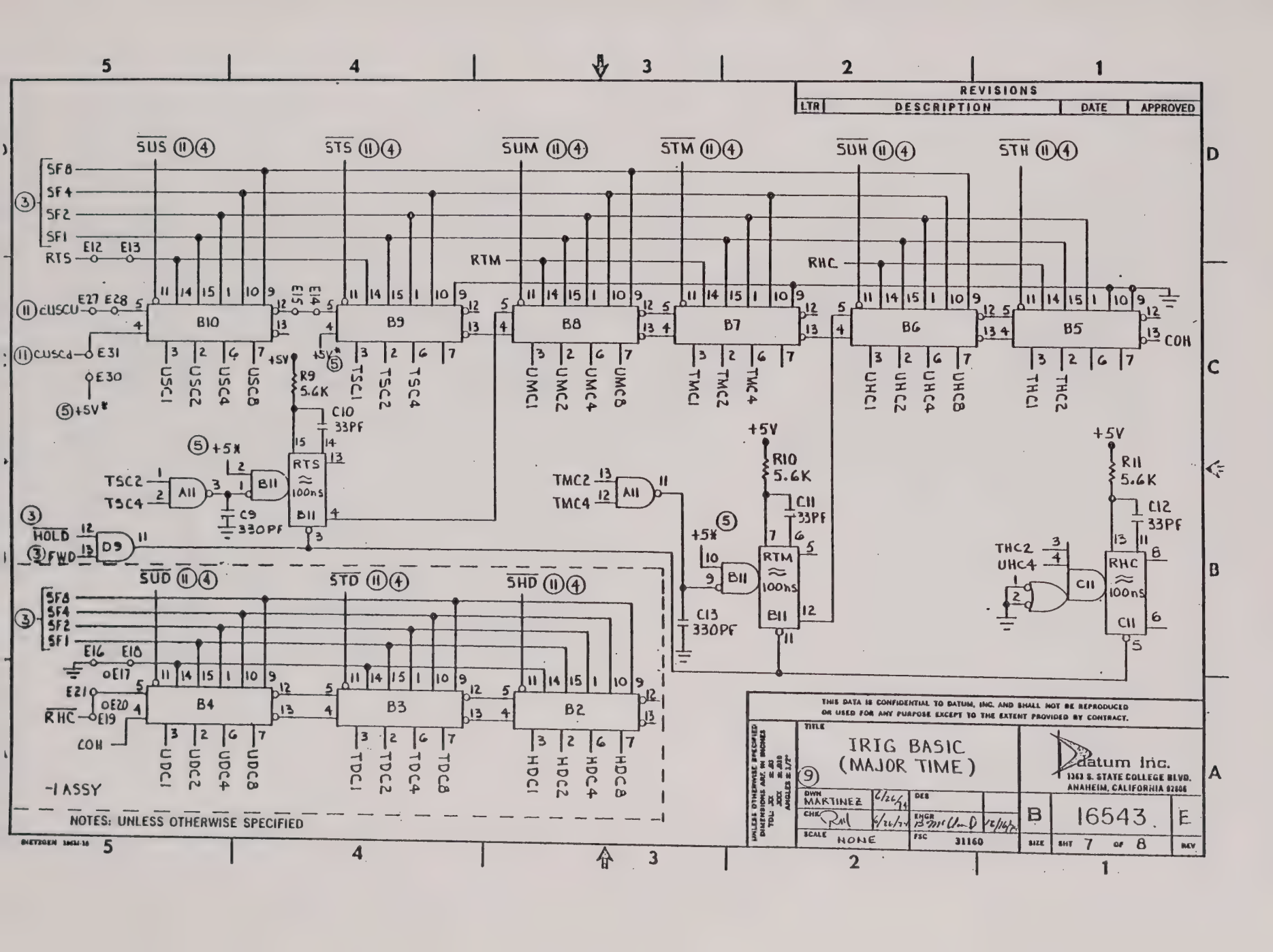
TITLE: IRIG BASIC (8) (MINOR TIME)

DWN IC	6/25/74	DES	
CHK	6/26/74	ENGR	12/16/74
SCALE NONE		FSC 31160	

datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

B | 16543 | E

SIZE | SHT 6 OF 8 | REV


REVISIONS
LTR DESCRIPTION DATE APPROVED
SUS ⑪④
STS ⑪④
SUM ⑪④
STM ⑪④
SUH ⑪④
STH ⑪④
SF8
SF4
SF2
SF1
RTS
RTM
RHC
E12 E13
E27 E28
E15 E14
E31
E30
⑪CUSCU
⑪CUSC4
⑤+5V*
B10
B9
B8
B7
B6
B5
USC1 USC2 USC4 USC8
TSC1 TSC2 TSC4
UMC1 UMC2 UMC4 UMC8
TMC1 TMC2 TMC4
UHC1 UHC2 UHC4 UHC8
THC1 THC2
COH
R9 5.6K
C10 33PF
RTS ≈ 100ns
B11
A11
TSC2
TSC4
C9 330PF
HOLD
FWD
D9
TMC2
TMC4
R10 5.6K
C11 33PF
RTM ≈ 100ns
C13 330PF
R11 5.6K
C12 33PF
THC2
UHC4
C11
RHC ≈ 100ns
SUD ⑪④
STD ⑪④
SHD ⑪④
E16 E18
E17
E21
E20
E19
RHC
COH
B4
B3
B2
UDC1 UDC2 UDC4 UDC8
TDC1 TDC2 TDC4 TDC8
HDC1 HDC2 HDC4 HDC8
-1 ASSY
NOTES: UNLESS OTHERWISE SPECIFIED
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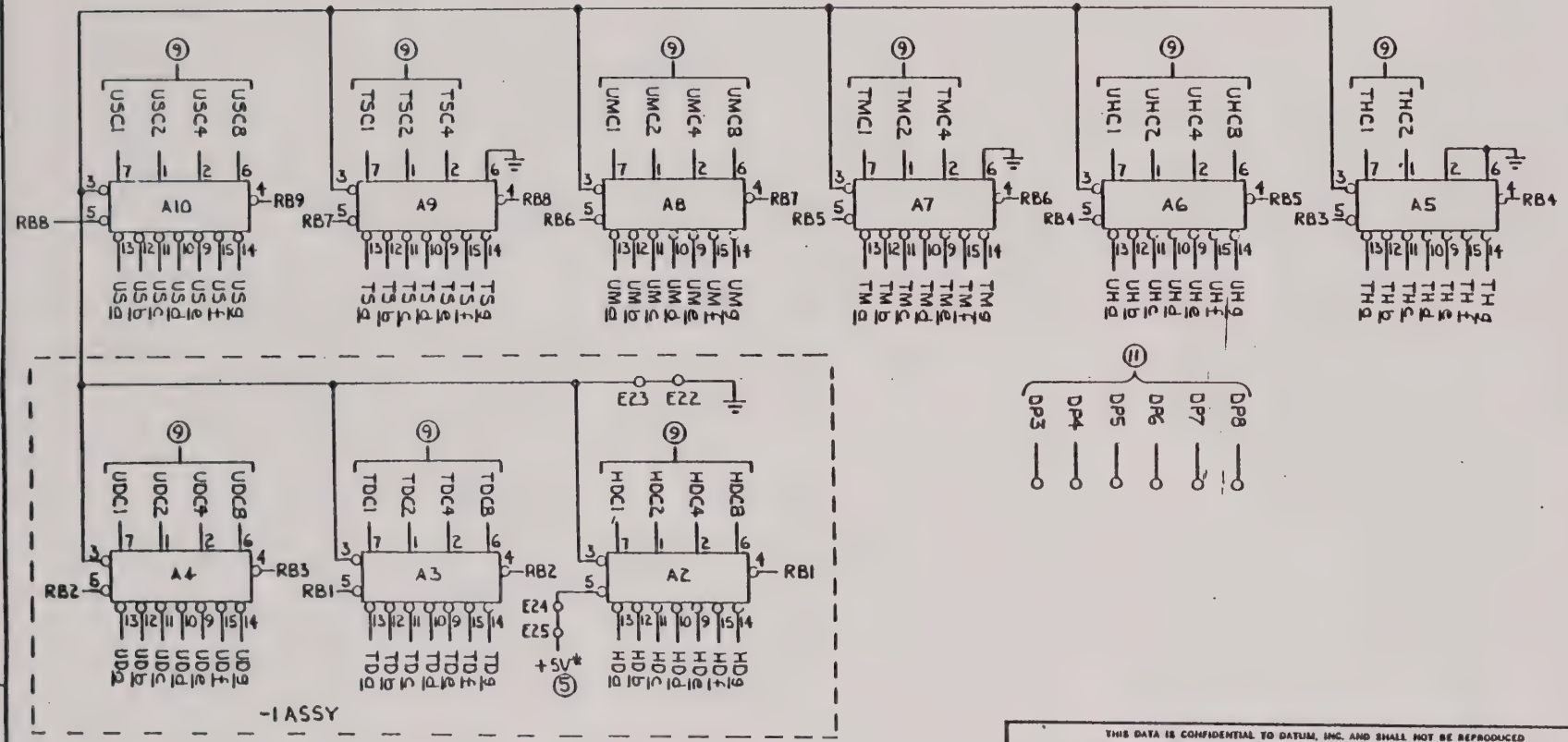
TITLE
IRIG BASIC (MAJOR TIME)
⑨
datum inc.
1363 S. STATE COLLEGE BLVD. ANAHEIM, CALIFORNIA 92806
DWN MARTINEZ 2/24/74
CHK 6/26/74
ENGR 6/26/74
SCALE NONE
FSC 31160
B 16543 E
SIZE SHT 7 OF 8 REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOL: .XX ± .03, .XXX ± .010, ANGLES ± 1/2°

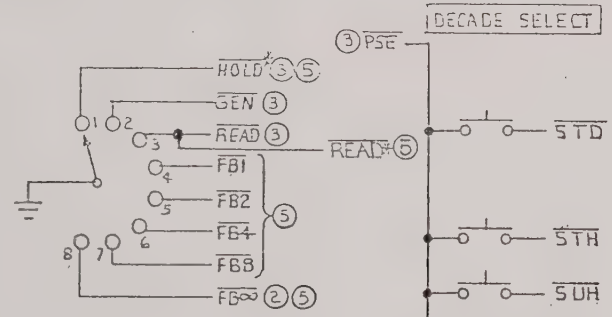
TITLE: IRIG BASIC (10) (DISPLAY DRIVERS)

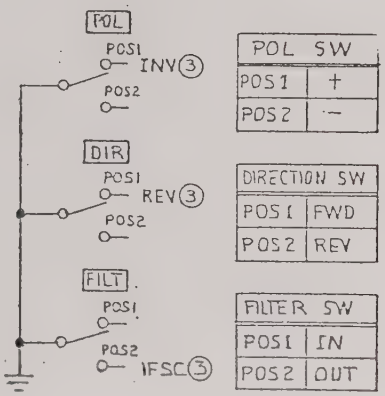
DWN	IC	6/25/74	DES		
CHK			ENGR		
SCALE	NONE		FSC	31160	

datum Inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

SIZE		SHT	REV
B	16543	8 of 8	E

POS.	MODE SW.
1	HOLD
2	GEN
3	READ
4	FB1
5	FB2
6	FB4
7	FB8
8	FB∞

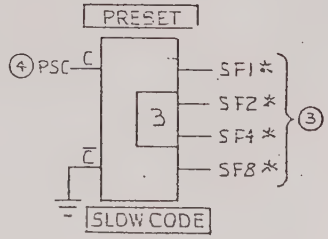


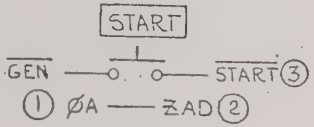


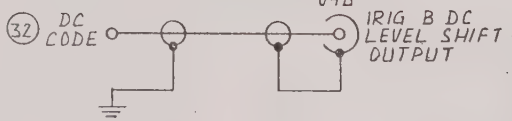
POL SW	
POS 1	+
POS 2	−

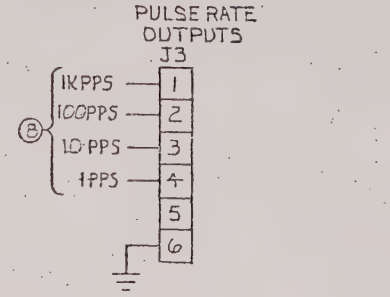
DIRECTION SW	
POS 1	FWD
POS 2	REV

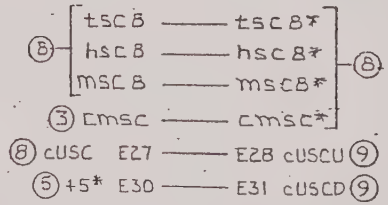
FILTER SW	
POS 1	IN
POS 2	OUT











TERMS REFERENCED TO THIS DRAWING AND NOT SHOWN, ARE NOT USED IN THIS CONFIGURATION.

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

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TITLE: (11) SWITCH & CONTROL LOGIC (9300-7509)

DWN SATINDER 8/87 DES

CHK ENGR 8/87

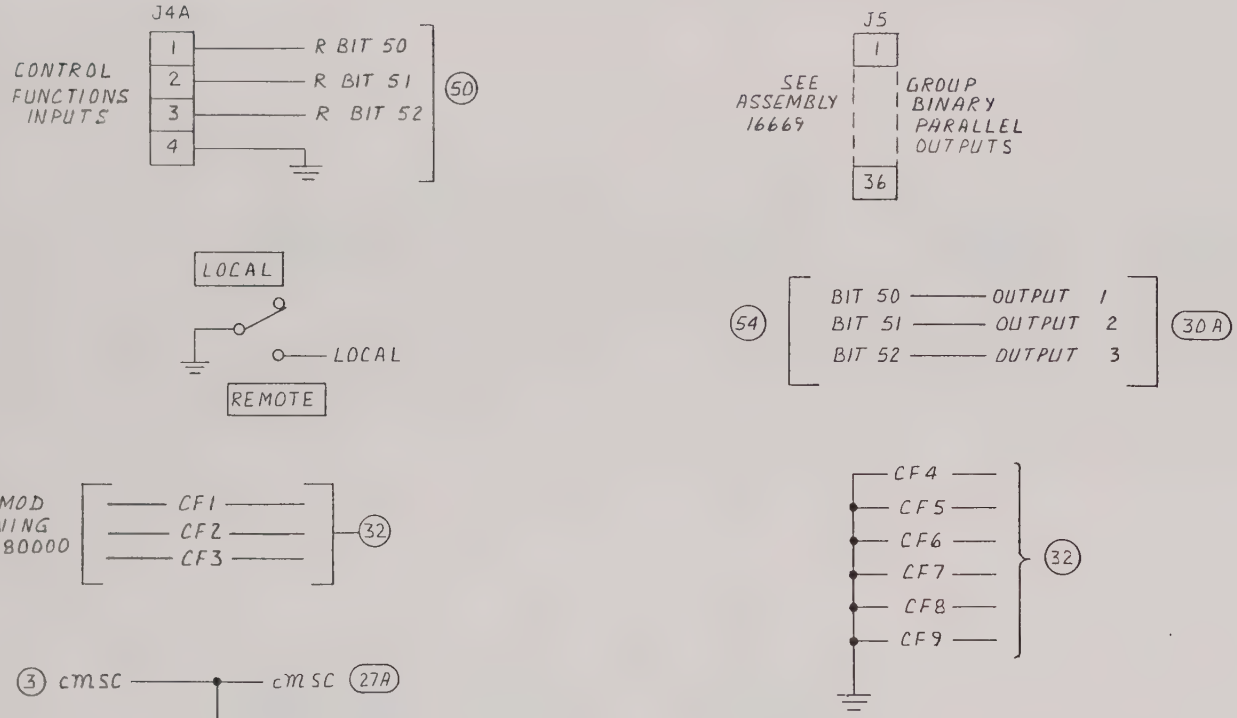
SCALE NONE FSC 31160

SIZE B | SHT 1 OF 2 | REV 9300-8999

Datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92805

T/F 9300-8090

DISTRIGEN 1360M-10



(11) SWITCH & CONTROL LOGIC	B	9300-8999	
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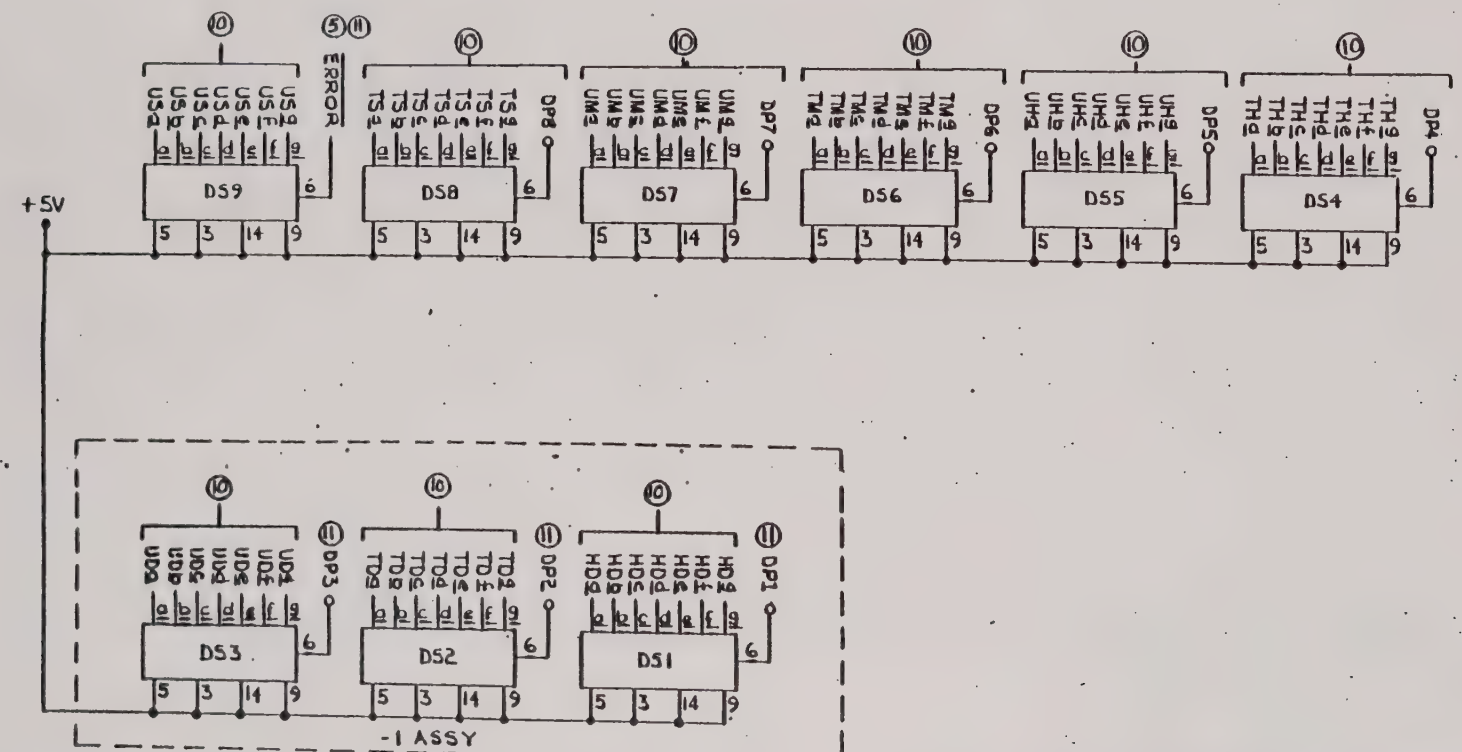
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-0288

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
–	ADDED -4, -5, -6	10-21-71	CC



-5 LEDS ARE YELLOW, H/P 5082-7660
-4 LEDS ARE GREEN, H/P 5082-7670
-3 LEDS ARE FAIRCHILD FND-507
-2 LEDS ARE MONSANTO MAN6A
1. LEDS ARE H/P 5082-7650

NOTES: UNLESS OTHERWISE SPECIFIED

6 LEDS ARE MONSANTO, 6660

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL: .XX ±.03 .XXX ±.010 ANGLES ±1/2°

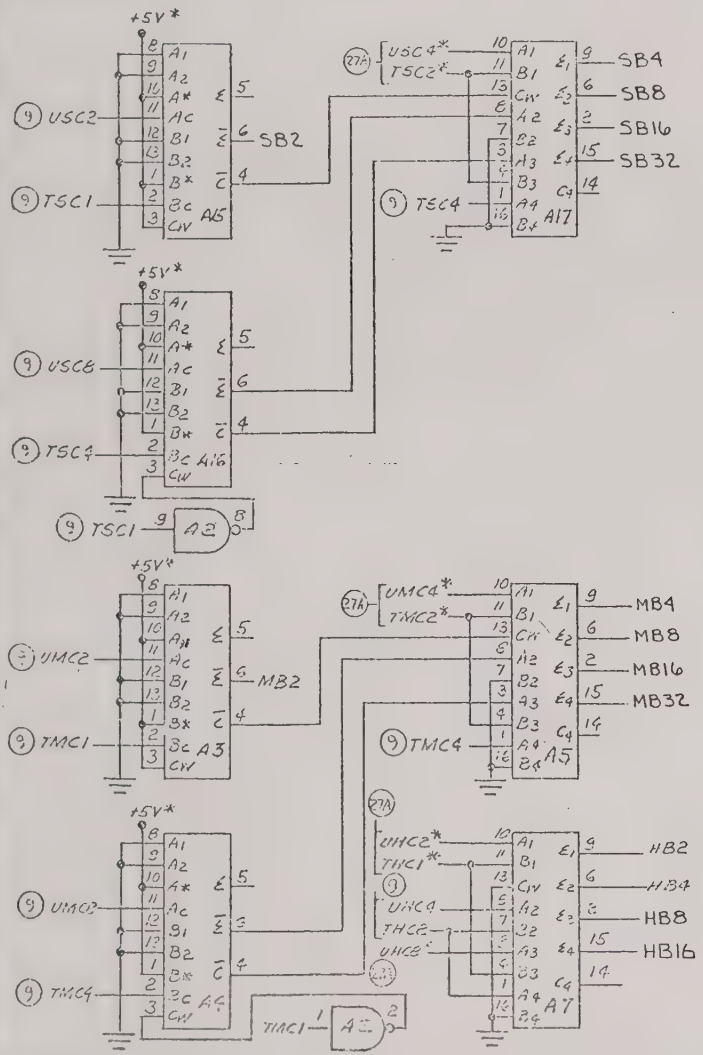
TITLE: LED DISPLAY (12)

DWN	TC	6/26/74	DES	
CHK		7/2/74	ENGR	11/4/74
SCALE	NONE		FSC	31160

datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

B 16549

SIZE | SHT 1 OF 1 | REV



REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REVISED PARTLIST ECOT5292	5-28-86	BH

PART NO.	MFR.	REF.
SN74LS83N	TI.	A5,7,17
74LS08	SIGNETICS	A6,18
SN7480N	SPRAGUE	A3,4,15,16
74LS197	SIGNETICS	A1,13,19
74LS04	NATIONAL	A2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL .XX ± .010 .XXX ± .005 ANGLES ± 1/2°

TITLE (LOW POWER)
(27) GROUP BINARY CONVERTER (SMH)

Quantum inc.
170 E. LIBERTY AVE.
ANAHEIM, CALIFORNIA

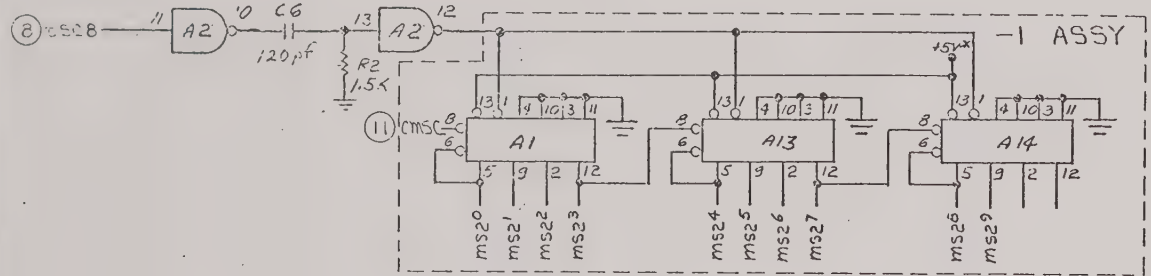
DWN KAIN 3/31/75 | DES | ENGR 4/8/86 | CHK | SCALE NONE | FSC 31300

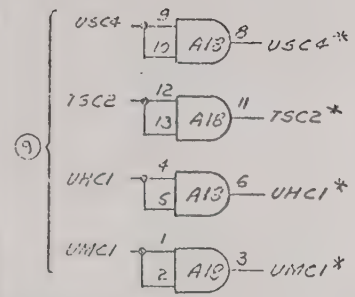
B | 16737 | A

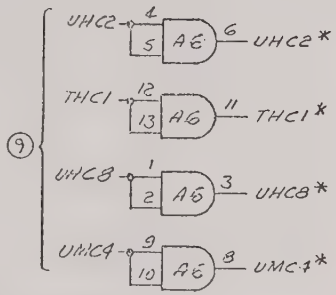
SIZE | SHT 1 OF 2

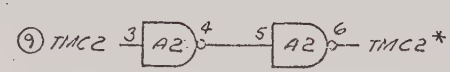
DIETZGEN 146MG10

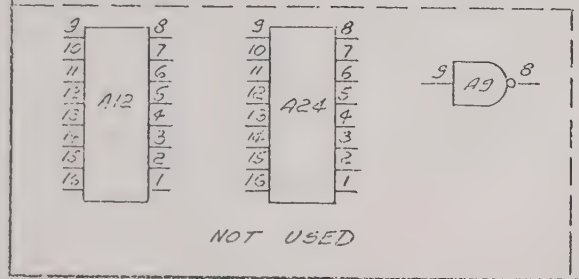
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

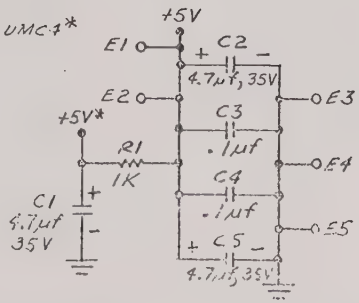








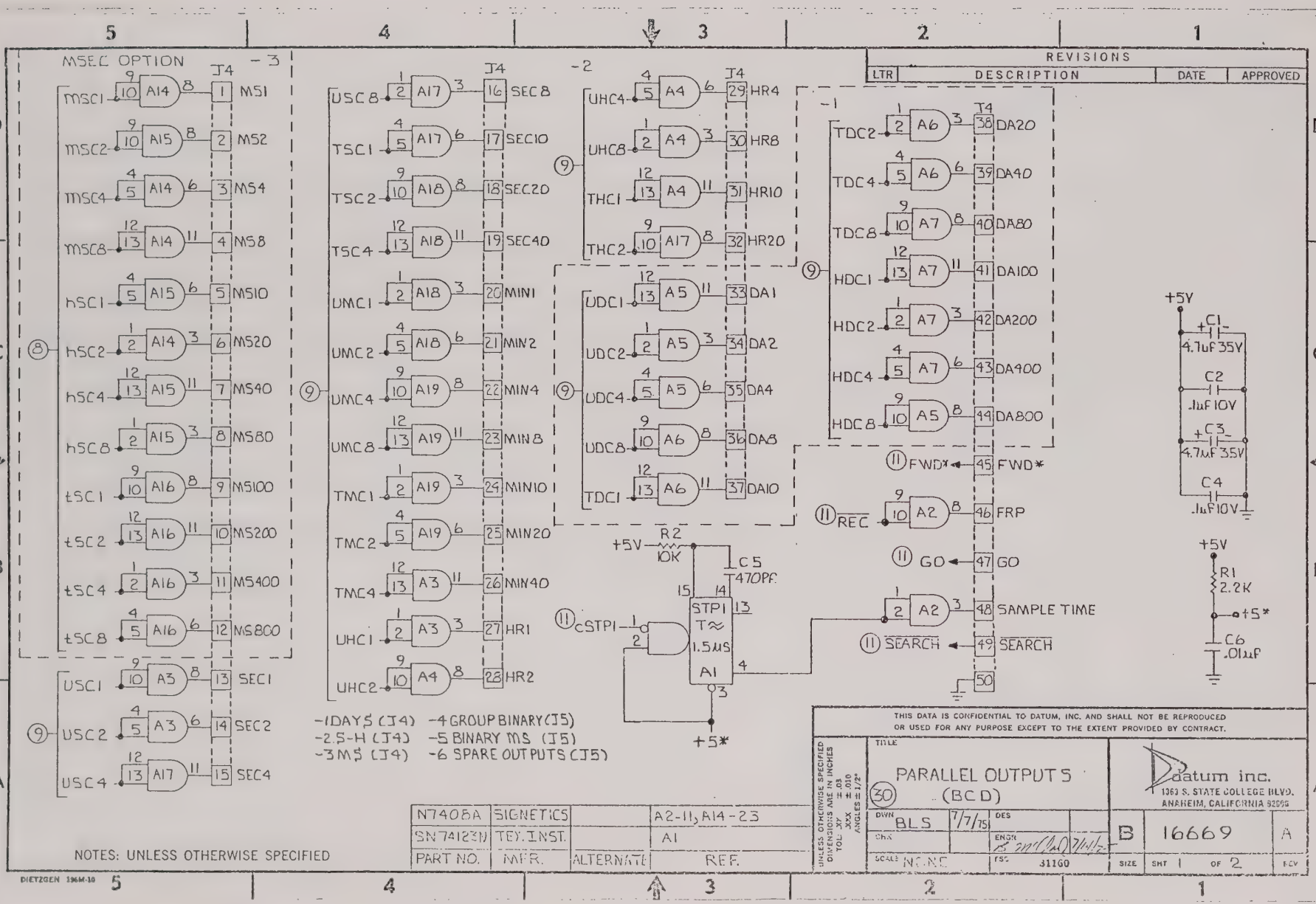


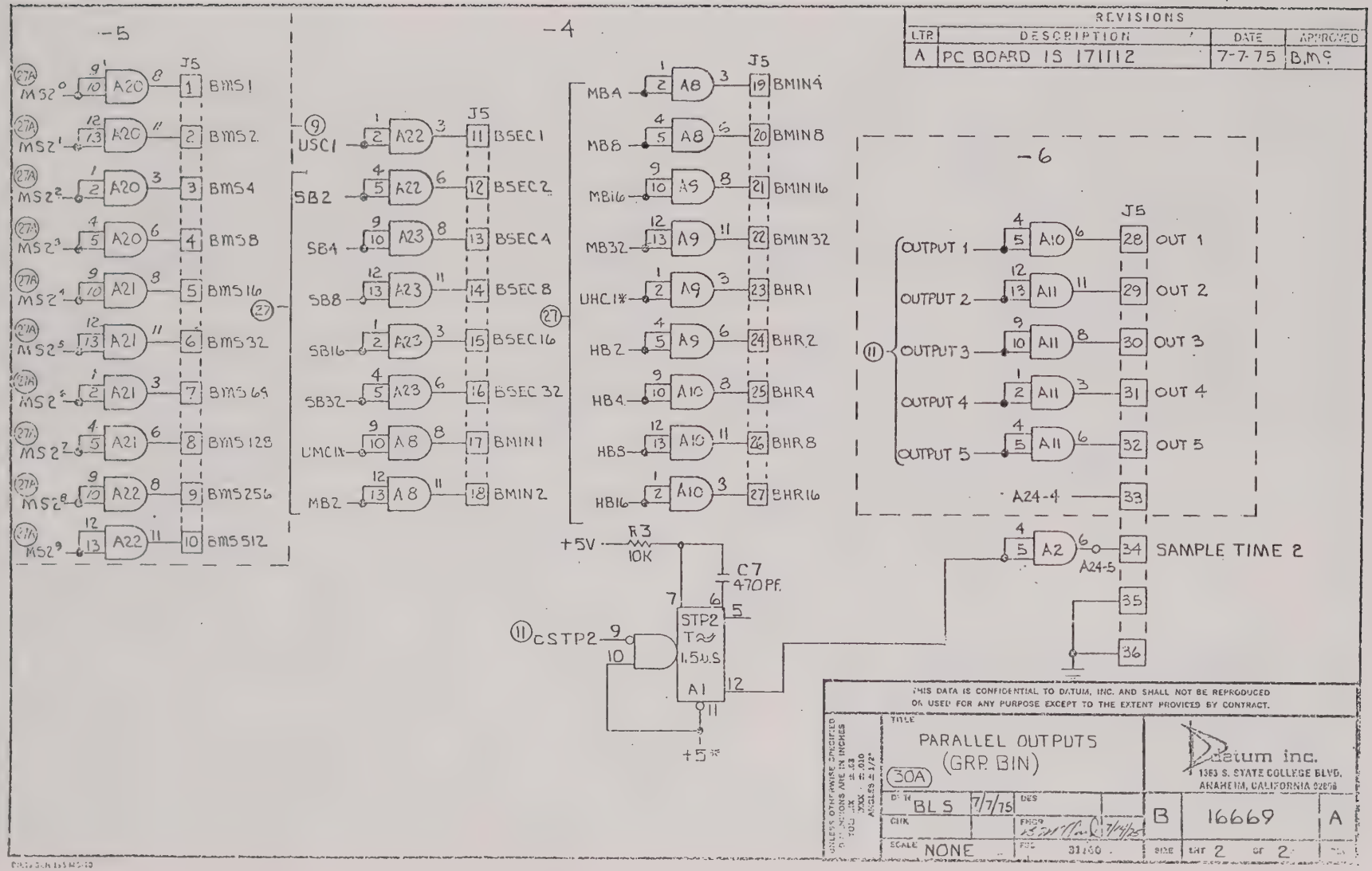


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: .XX ± .03 .XXX ± .010 ANGLES ± 1/2°

TITLE: (27A) (LOW POWER) GROUP BINARY CONVERTER (SMH)				datum inc. 170 E. LIBERTY AVE. ANAHEIM, CALIFORNIA
DWN KAIN	3/31/75	DES		B 16737 A
CHK		APPD	4/6/75	
SCALE NONE		FSO 31160		SIZE SHT 2 OF 2 REV

DIETZGEN 1564D-10


MSEC OPTION -3
-2
-1
J4
MS1
MS2
MS4
MS8
MS10
MS20
MS40
MS80
MS100
MS200
MS400
MS800
SEC1
SEC2
SEC4
SEC8
SEC10
SEC20
SEC40
MIN1
MIN2
MIN4
MIN8
MIN10
MIN20
MIN40
HR1
HR2
HR4
HR8
HR10
HR20
DA1
DA2
DA4
DA8
DA10
DA20
DA40
DA80
DA100
DA200
DA400
DA800
FWD*
FRP
GO
SAMPLE TIME
SEARCH
+5V
R2
10K
C5
470PF
STPI
T≈
1.5μS
CSTPI
+5*
C1
4.7μF 35V
C2
.1μF 10V
C3
4.7μF 35V
C4
.1μF 10V
R1
2.2K
C6
.01μF
-1 DAYS (J4)
-2 5-H (J4)
-3 MS (J4)
-4 GROUP BINARY (J5)
-5 BINARY MS (J5)
-6 SPARE OUTPUTS (J5)
NOTES: UNLESS OTHERWISE SPECIFIED
REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.
TITLE
PARALLEL OUTPUTS (BCD)
30
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806
DWN BLS 7/7/75
DES
CHK
ENGR
SCALE NONE
FSC 31160
SIZE B
16669
A
SHT 1 OF 2
REV
N7408A SIGNETICS A2-11, A14-23
SN74123N TEX. INST. A1
PART NO. MFR. ALTERNATE REF.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL .XX ± .01 .XXX ± .010 ANGLES ± 1/2°
DIETZGEN 196M-10



REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	PC BOARD IS 171112	7-7-75	B.M.S

THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: .XX ± .03, .XXX ± .010, ANGLES ± 1/2°

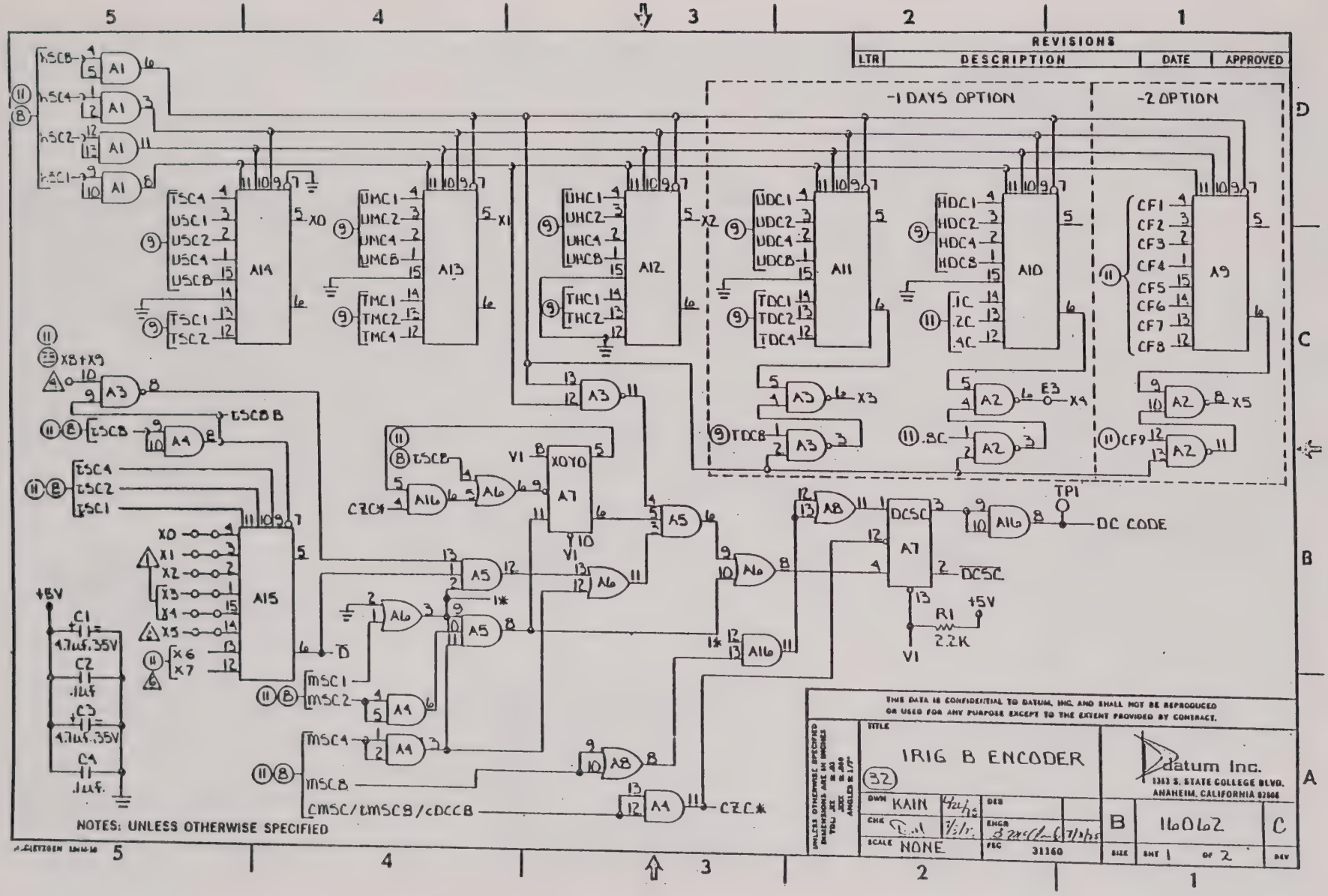
TITLE: PARALLEL OUTPUTS (GRP BIN)

30A

DRN	BLS	7/7/75	DES		
CHK			ENGR		7/7/75
SCALE	NONE		FSC	31560	

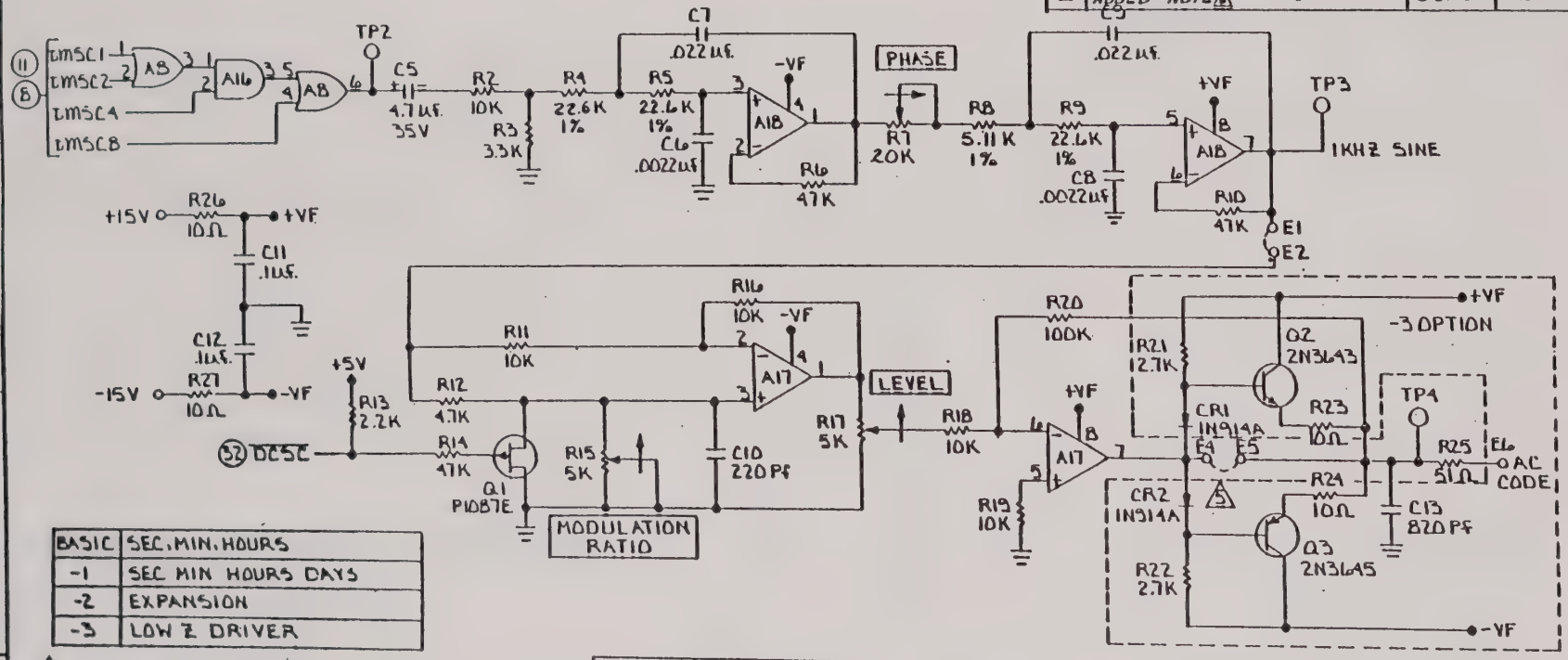
Datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

SIZE			
B	16669		A
	SHT 2 OF 2		


REVISIONS
LTR | DESCRIPTION | DATE | APPROVED
-1 DAYS OPTION
-2 OPTION
NOTES: UNLESS OTHERWISE SPECIFIED
THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.
TITLE
IRIG B ENCODER
(32)
DWN KAIN
CHK
ENGR
SCALE NONE
PSC 31160
SIZE B
160162
SHT 1 OF 2
REV C
datum Inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806
DC CODE
TP1
+5V
R1
2.2K
C1
4.7uf.35V
C2
.1uf
C3
4.7uf.35V
C4
.1uf.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	R4 WAS 20.5K PER CO# 3759	2-3-77	[illegible]
—	ADDED (11) REF.'s CF1-CF9W-2	11-14-77	CC/[illegible]
B	REVISED PER C.O.#T3755	5-31-79	LS/SR
—	ADDED NOTE 6	3-27-81	IC

IC A17 WAS 74107 PER ECO T3662 | 6-15-84 | IC



BASIC	SEC, MIN, HOURS
-1	SEC MIN HOURS DAYS
-2	EXPANSION
-3	LOW Z DRIVER

6 GND WHEN C/F SCAN NOT USED

5 REMOVE JUMPER FROM E4-E5 WHEN -3 OPTION IS USED.

4 GROUND WHEN 17 BIT BINARY NOT USED.

3 GROUND PIN 14 WHEN -2 OPTION IS NOT USED.

1 CUT ETCH AND GROUND PINS 12 & 15 WHEN DAYS OPTION IS NOT USED.

NOTES: UNLESS OTHERWISE SPECIFIED

PART NO.	MFR	REF. DES.
N5558V	SIGNETICS	A17, A18
N74151N	T.I.	A9-15
SN74LS107N	TI	A7
N7432A	NATIONAL	A6, 8
N7411A		A5
N7408A		A1, A4, A16
N7400A	NATIONAL	A2, A3

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL .XX ±.02 .XXX ±.010 ANGLES ±1°

TITLE: IRIG B ENCODER (32A)

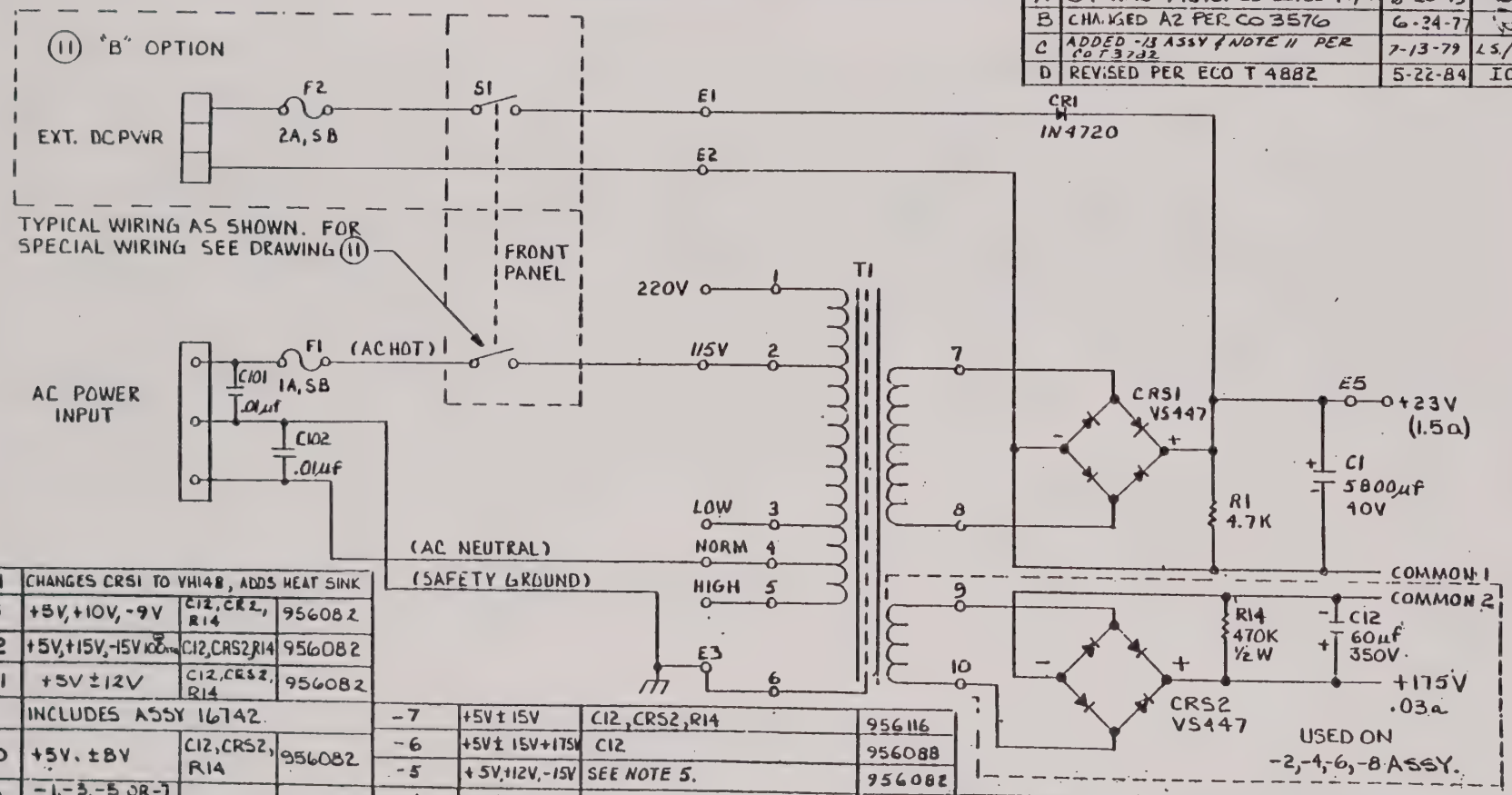
DWN KAIN 6/26/85 | CHK [signature] 7/3/85 | ENGR [signature] 7/8/85 | SCALE NONE | FSC 81160

datum Inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

B | 16062 | C

SIZE | SHT 2 OF 2 | REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	C4 WAS 948901 SELECTED 47μf	6-26-73	RM
B	CHANGED A2 PER CO 3576	6-24-77	
C	ADDED -13 ASSY & NOTE 11 PER CO T 3782	7-13-79	LS
D	REVISED PER ECO T 4882	5-22-84	IC
E	REVISED PER ECO T5126	10.3.85	SATINDER
F	REVISED PER ECO T5498	4-8-87	BH



DASH NO			
-H	CHANGES CRS1 TO VH148, ADDS HEAT SINK		
-13	+5V, +10V, -9V	C12, CR2, R14	956082
-12	+5V, +15V, -15V 100ma	C12, CRS2, R14	956082
-11	+5V ±12V	C12, CRS2, R14	956082
A	INCLUDES ASSY 16742		
-10	+5V, ±8V	C12, CRS2, R14	956082
-9	-1, -3, -5, OR -7 USED WITH 16742		
-8	+5V, +12, -15, +175	C12	956088
DASH NO		COMP. NOT USED	XFORMER USED

NOTES: UNLESS OTHERWISE SPECIFIED

DASH NO.		COMP'S NOT USED	XFORMER USED
-7	+5V ± 15V	C12, CRS2, R14	956116
-6	+5V ± 15V +175V	C12	956088
-5	+5V, +12V, -15V	SEE NOTE 5.	956082
-4	+5V, ±15V, +175V		956088
-3	+5V, ±15V	C12, CRS2, R14	956082
-2	+5V, +175V	A2, A3, C8, C9, C10, C11, CR7, CR8	956088
-1	+5 ONLY	A2, A3, C8, C9, C10, C11, C12, CR7, CRS2, R14, CR8	956082

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOL .XX ±.02 .XXX ±.005 ANGLES ± 1/2°

TITLE: POWER SUPPLY

(49)

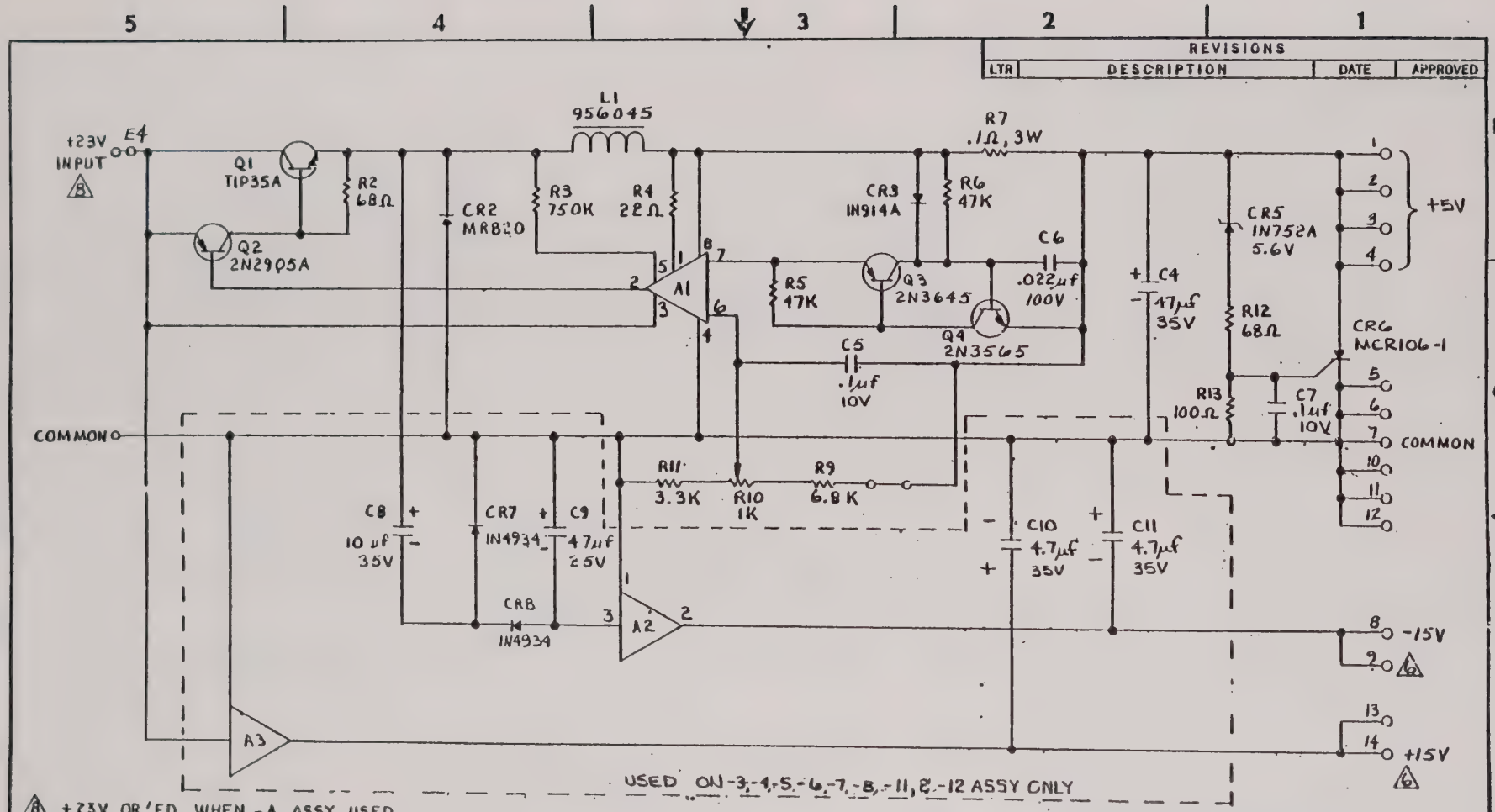
DWN	EK 3/23/73	DES	5/30/73
CHK	4/27/73	ENGR	6/73
SCALE	NONE	PBC	31160

datum Inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

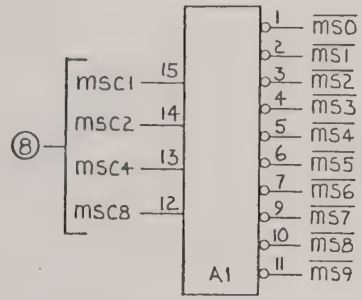
B | 16280 | F

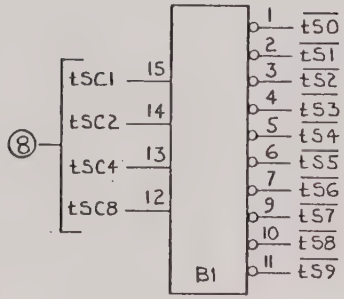
SHT 1 OF 2

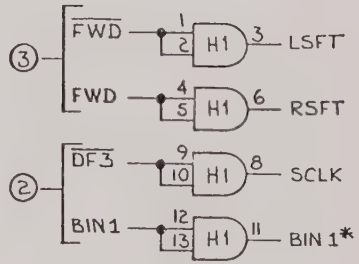
DIETZGEN 1MM-10

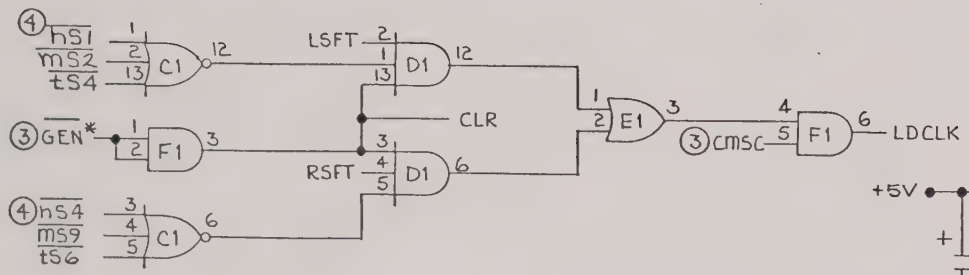

REVISIONS
LTR DESCRIPTION DATE APPROVED
+23V INPUT
E4
L1 956045
Q1 TIP35A
Q2 2N2905A
R2 68Ω
CR2 MR820
R3 750K
R4 22Ω
A1
R5 47K
Q3 2N3645
Q4 2N3565
CR3 IN914A
R6 47K
R7 .1Ω, 3W
C6 .022µf 100V
C4 47µf 35V
C5 .1µf 10V
CR5 IN752A 5.6V
R12 68Ω
CR6 MCR106-1
R13 100Ω
C7 .1µf 10V
+5V
COMMON
R11 3.3K
R10 1K
R9 6.8K
C8 10 µf 35V
CR7 IN4934
C9 47µf 25V
CR8 IN4934
A2
C10 4.7µf 35V
C11 4.7µf 35V
-15V
+15V
A3
USED ON -3, -4, -5, -6, -7, -8, -11, & -12 ASSY ONLY
+23V OR 'ED WHEN -A ASSY USED
-10 ASSY A3 IS 7808, A2 IS 7910B
-5 & -8 ASSY OUTPUT IS +12V -10 ASSY OUTPUT IS ± 8V
5. -5 ASSY A3 IS UGA7812393 OR MC7812 CP
4. A3 IS UGA7815393 OR MC7815CP
3. A2 IS MC7915CP OR 7915UC
2. A1 IS LM305
1. RESISTORS ARE ¼ W, 5%
NOTES: UNLESS OTHERWISE SPECIFIED
12. -11 ASSY: CR51 IS VH148; ADD HEAT SINK.
11. -13 ASSY: A2 IS LM7909CT; A3 IS LM7810CT
10. -12 ASSY: A2 IS 7915UC
9. -11 ASSY: A2 IS MC7912CP, A3 IS MC7812CP
TITLE
REGULATOR
49
DWN EK 3/22/73
CHK 3/30/73
ENGR 6/73
SCALE NONE
FSC 31160
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806
SIZE B
16280
REV F
SHT 2 OF 2

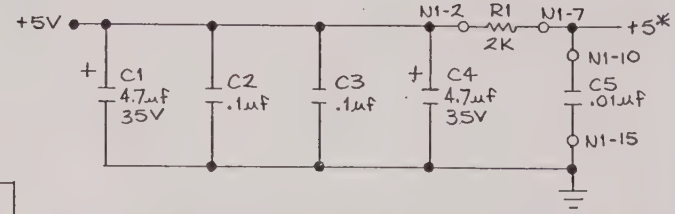
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REVISED PER ECO T5611	8-25-87	LN











N7442	SIGNETICS	A1, B1
N7432A	SIGNETICS	E1
SN7427	T. I.	C1
SN7411A	T. I.	D1
N7408A	SIGNETICS	F1, H1
SN74194	T. I.	A2 THRU D2
SN74174N	T. I.	E2 THRU H2
PART NO	MFR	REF

NOTES: UNLESS OTHERWISE SPECIFIED

THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL: .XX ± .03 .XXX ± .010 ANGLES ± 1/2°

TITLE: CONTROL FUNCTION DECODER (53) (DECODE TIMING)

DRN VALENCIA 2/3/77 DES

CHK ENGR 4/24/77

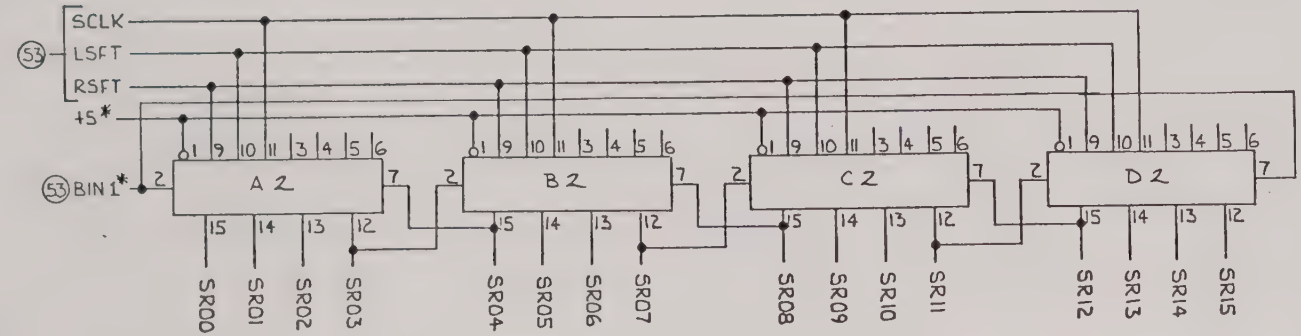
SCALE NONE FSC 31160

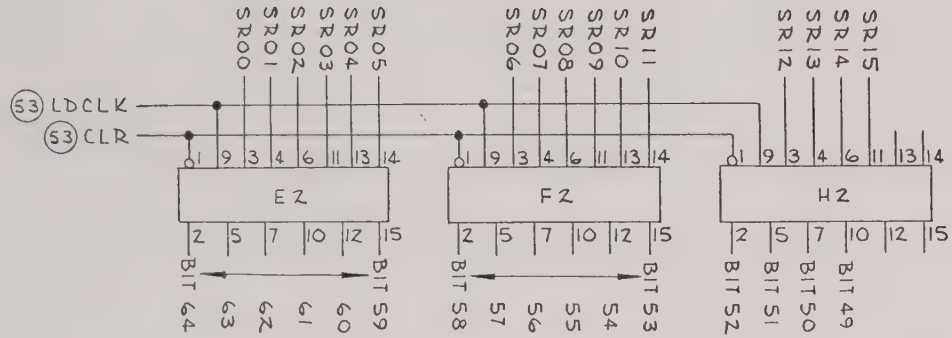
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

B 17082 A

SIZE SHT 1 OF 2 REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED





NOTES: UNLESS OTHERWISE SPECIFIED

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL .XX ± .03 .XXX ± .010 ANGLES ± 1/2°

TITLE: CONTROL FUNCTION DECODER (54) (SHIFT REG. & STORAGE)

DWN VALENCIA	2/3/77	DES	
CHK		ENGR	2/24/77
SCALE NONE		FSC 31160	

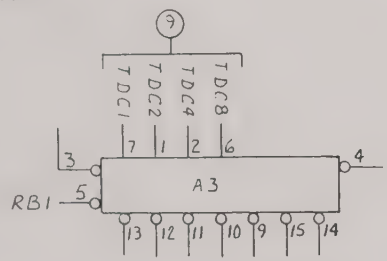
datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92805

B	17082	A
SIZE	SHT 2 OF 2	REV

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

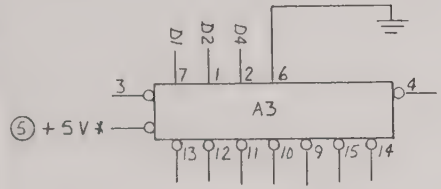
THE FOLLOWING MODIFICATION WAS MADE TO ASSEMBLY 16543 (10) :

WAS :



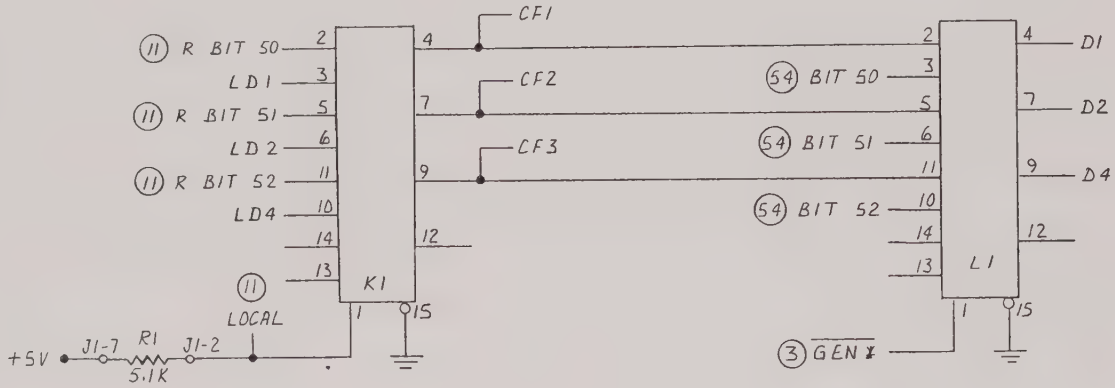
-1 ASSY (NOT USED)

IS :



(THIS DRIVER IS USED)

THE FOLLOWING CIRCUITRY WAS ADDED TO ASSEMBLY 17082 :



74LS157	K1, L1
DEVICE TYPE	REF. DES.

THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOL: .XX ± .03 .XXX ± .010 ANGLES ± 1/2°

TITLE: MODIFICATION DRAWING

datum inc.
1363 S. STATE COLLEGE BLVD.
ANAHEIM, CALIFORNIA 92806

DWN	CHK	DES	ENGR	SCALE	FSC
SATINDER 8787			9/67		31160

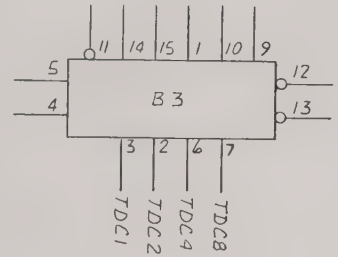
SIZE		SHT	OF	REV
B	9300-80000	1	2	

NOTES: UNLESS OTHERWISE SPECIFIED

THE FOLLOWING MODIFICATION WAS MADE TO ASSEMBLY 16543 (9) :

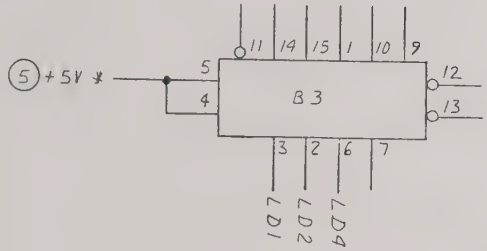
ON ASSEMBLY 16549, LED DISPLAY DS2 IS USED.

AS :



-1 ASSY (NOT USED)

IS :



(THIS COUNTER IS USED)

MODIFICATION DRAWING	B	9300-80000	
THIS DATA IS CONFIDENTIAL TO DATUM, INC. AND SHALL NOT BE REPRODUCED OR USED FOR ANY PURPOSE EXCEPT TO THE EXTENT PROVIDED BY CONTRACT.	SIZE	SHT 2 OF 2	REV

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-0288

SECTION SEVEN
LIST OF MATERIALS

The following terms are used on the materials lists form. Their specific usage is explained below to aid in using the included information for replacement part logistics.

a. ITEM -- A numeric listing of each part or component comprising each assembly.
b. STOCK/PART Number -- Each part or component is identified by its DATUM stock number or original manufacturer's part number. A DATUM stock number is used when the part is maintained in DATUM's stock inventory. The manufacturer's part number is used when the part is not maintained in inventory.
c. DESCRIPTION -- Each part or component is identified by its descriptive nomenclature.
d. MFR/SPEC --Each part or component availability source is listed. Those items identified with DATUM stock numbers show "DATUM". Those not in inventory (and listed by original manufacturer's part number) show the original manufacturer.
e. QTY -- The quantity of each item utilized in the assembly.
f. REF. DES. --Identification of the part or component as indicated on the support schematic drawing.
g. UNIT COST, LOT TOTAL --For customer use, as desired.

NOTE

The following Material List is intended as only a reference guide, and not as spare parts list to be sold individual pieces.

1.	Time Code Generator/Translator	9300-7509
2.	Time Code Generator/Translator	9300-001
3.	AGC	16085
4.	IRIG Basic	16543-36
5.	LED Display	16549
6.	Group Binary Converter	16737-1
7.	IRIG B Encoder	16062-2
8.	Power Supply	16280-3
9.	Parallel Outputs	16669-456
10.	Control Function Decoder	17082

DATE: 7.21.87

DRAWN: SATINDER

CHK: _____

PARTS LIST

datum inc.

JOB NO: _____

QUANTITY _____

REV

TITLE: TIME CODE GEN/TRANS

ASS'Y NO: 9300 - 7509

SHT 1 OF 2

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
1	SK9100-6	SHIPPING KIT	DATUM	1			
2							
3	0102-0512	RESISTOR 5.1K, 1/4W. 5%	"	1	R1		
4	0226-0104-2	CAPACITOR .1μf	"	1			
5	0302-LS15-7	I.C. 74LS157	"	2			
6	1202-0102	SWITCH SPDT	"	5			
7	1204-3903	" P/B	"	8			
8	1206-5112-N	" ROTARY	"	1			
9	1212-7606-1	" T/W	"	1			
10	1299-7656-1	BAND HDWE	"	1			
11	1704-1002	CONNECTOR BNC	"	3			
12	"-1625-4R	" 4P	"	1			
13	"-1625-6R	" 6P	"	1			
14	1792-1355	CONTACT SOCKET	"	10			
15	1708-3913	SOCKET 16P W/W	"	2			
16	1795-0002	WASHER	"	6			
17	2205-0006	LED DISPLAY	"	1	DS2 (GOES ON #549)		
18	2524-5010	KNOB	"	1			
19							
20	170979A	P.C. BOARD STK	"	1			
21							
22	700362	CTR SUPPORT STK	"	1			
23	700364-2	COVER STK	"	2			
24	700546	STIFFENER STK	"	6			
25	704757-2	SIDE GUSSET STK	"	2			
26	704899-1	REAR PANEL STK	"	1			

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A33971

DATE: 7.21.87
DRAWN SATINDER
CHK:

PARTS LIST

datum inc.

JOB NO:
QUANTITY

REV

TITLE: TIME CODE GEN/ TRANS

ASS'Y NO: 9300-7509

SHT 2 OF 2

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
27	705850	FRONT PANEL STK	DATUM	1			
28	705853	COVER PLATE STK	"	1			
29	707349-1	BUTCH " STK	"	1			
30	709960-3	LENS	"	1			
31	709961	SWITCH PLATE	"	1			
32	709962	BUTCH "	"	1			
33							
34	914138	MTG. BRKT. ASSY STK	"	2			
35	931500	HANDLE STK	"	2			
36							
37	16062-2	IRIG ENCODER	"	1			
38	16085	AGC STK	"	1			
39	16280-3	POWER SUPPLY STK	"	1			
40	16543-36	BASIC	"	1			
41	16549	DISPLAY	"	1			
42	16737-1	GROUND BINARY CONV.	"	1			
43	16669-456	PARALLEL OUTPUTS	"	1	⚠1		
44	17082	CONTROL FUNC. DECODER	"	1			

NOTES: ⚠1 SHEAR OFF J4 BEFORE ASSY

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A33971

DATE: 1-18-78
DRAWN: R. FLOCK
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY

REV D

TITLE: TIME CODE GEN/TRANS BASIC

ASS'Y NO: 9300-001

SHT1 OF 2

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
1	0226-0104-1	CAPACITOR .1 MF @100V	DATUM	1	C101		
2							
3	1202-0102	SWITCH SPDT	"	4			
4	1204-3903	SWITCH P/B	"	10			
5	1206-5112-N	SWITCH ROTARY	"	1			
6	1212-7606-1	SWITCH T/W	"	1			
7	1299-76SG-1	BAND HDWE	"	1			
8							
9	1704-1002	RECEPT BNC	"	2			
10	1704-1625-6R	RECEPT 6P	"	1			
11	1792-1855	SOCKET	"	6			
12	1795-0001	WASHER	"	2			
13	1795-0002	WASHER	"	2			
14							
15	2325-2005	FASTENER	"	2			
16	2524-5010	KNOB	"	1			
17							
18	700362	CENTER SUPPORT STK	"	1			
19	700364-2	COVER STK	"	2			
20	700546	STIFFENER STK	"	3			
21	703995	MTG BKT STK	"	2			
22	704757-2	SIDE GUSSET STK	"	2			
23	704889-1	REAR PANEL STK	"	1			
24	707349-1	BUTCH PLATE STK	"	1			
25							
26							

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A19506

DATE: 1-18-78
DRAWN: R. FLOCK
CHK:

MATERIAL LIST

Datum inc.

JOB NO:
QUANTITY

REV D

TITLE: TIME CODE GEN/TRANS BASIC

ASS'Y NO: 9300-001

SHT2 OF2

ITEM	STOCK/PART NO.	DESCRIPTION		MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
27	705850	FRONT PANEL	STK	DATUM	1			
28	705853	COVER PLATE	STK	"	1			
29	705866-3	LENS	STK	"	1			
30								
31	931500	HANDLE	STK	"	2			
32								
33	170979 A	P. C. BOARD	STK	"	1			
34								
35	16062-1	IRIG ENCODER	STK	"	1			
36	16085	AGC	STK	"	1			
37	16280-3	POWER SUPPLY	STK	"	1			
38	16543-16	BASIC	STK	"	1			
39	16549-1	DISPLAY	STK	"	1			

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO A19506

DATE: 3-06-75
DRAWN: RGE
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY
TITLE: AGC
ASS'Y NO: 16085

REV H
SHT 1 OF 3

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
1	0102-0330	RESISTOR 33 OHM 1/4W 5%	DATUM	1	R10		
2	0102-0910	" " 91 OHM " "	"	1	R3		
3	0102-0391	" " 390 OHM " "	"	1	R44		
4	0102-0511	" " 510 OHM " "	"	1	R18		
5	0102-0561	" " 560 OHM " "	"	1	R17		
6	0102-0102	" " 1 K " "	"	7	R21, 22, 26, 33, 38, 43, 45		
7	0102-0122	" " 1.2 K " "	"	1	R37		
8	0102-0152	" " 1.5 K " "	"	1	R30		
9	0102-0202	" " 2 K " "	"	1	R46		
10	0102-0272	" " 2.7 K " "	"	3	R25, 32, 39		
11	0102-0302	" " 3 K " "	"	1	R31		
12	0102-0512	" " 5.1 K " "	"	8	R4, 8, 12-14, 20, 34, 40		
13	0102-0682	" " 6.8 K " "	"	1	R29		
14	0102-0752	" " 7.5 K " "	"	1	R16		
15	0102-0103	" " 10 K " "	"	7	R5-7, 11, 28, 36, 41		
16	0102-0183	" " 18 K " "	"	1	R24		
17	0102-0473	" " 47 K " "	"	1	R23		
18	0102-0753	" " 75 K " "	"	1	R19		
19	0102-0124	" " 120 K " "	"	4	R2, 9, 15, 35		
20	0102-0274	" " 270 K " "	"	1	R47		
21	0102-0105	" " 1 M " "	"	3	R1, 27, 42		
22	0104-0221	" " 220 OHM 1/2W "	"	1	R48		
23							
24	0220-0474	CAPACITOR .47 MF 35V	"	2	C4, 8		
25	0220-0105	CAPACITOR 1 MF "	"	6	C2, 15, 16, 19-21		
26	0220-0475	CAPACITOR 4.7 MF "	"	5	C3, 12, 13, 17, 18		

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A19506

DATE: 3-06-75
DRAWN: RGE
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY
TITLE: AGC

REV H

ASS'Y NO: 16085

SHT 2OF3

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
27	0220-0107	CAPACITOR 100 Mf 10V	DATUM	1	C14		
28	0221-0221	" " 220 Mf 4V	""	2	C11A, 11B		
29	0225-0471	" " 470 Pf	""	1	C22		
30	0225-0152	" " 1500 Pf	""	1	C10		
31	0226-0100	" " 10 Pf	""	1	C6		
32	0226-0470	" " 47 Pf	""	1	C9		
33	0226-0103-1	" " .01 Mf 100V	""	1	C7		
34	0226-0203	" " .02 Mf "	""	1	C5		
35	0226-0104-1	" " .1 Mf "	""	1	C1		
36							
37	0301-7405	IC N7405A	""	1	A5		
38	0301-7749	IC N6A7749393	""	2	A1, 4		
39	0301-9311-H	IC LM311H	""	2	A2, 3		
40							
41	0500-0306	DIODE IN914A	""	2	CR1, 3		
42	0515-0705-1	DIODE IN705A	""	1	CR2		
43	0515-0752-1	DIODE IN752A	""	1	CR4		
44							
45	0550-7705	TRANSISTOR 2N3565	""	1	Q6		
46	0555-6600	" " 2N3645	""	1	Q7		
47	0570-1087	" " P1087E	""	3	Q3-5		
48	0570-8703	" " U1487E	""	1	Q2		
49	0570-8704	" " 988704	""	1	Q1		
50							
51							
52							

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO A19506

DATE: 3-06-75
DRAWN: RGE
CHK:

MATERIAL LIST

TITLE: AGC

datum inc.

JOB NO:
QUANTITY

REV H

ASS'Y NO: 16085

SHT 8 OF 3

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
53	1708-3100-1	SOCKET 14P	DATUM	3			
54	1708-8000	SOCKET 8P	"	2			
55							
56	170574 E1	P. C. BOARD STK	"	1			
57	170785 N/C	P. C. BOARD STK	"	1			

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO A19506

DATE: 10-16-74
DRAWN: RAE
CHK:

MATERIAL LIST

Datum Inc.

JOB NO.
QUANTITY:

E

SHT 1 OF 2

TITLE: IBIC BASIC

ASSY NO: 16543-36

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	EXT TOTAL
1	0102-0151	RESISTOR 150Ω 1/4W 5%	DALE	1	R3		
2	" -0102	" 1K " "	"	1	R4		
3							
4	" -0512	" 5.1K " "	"	1	R1		
5	" -0562	" 5.6K " "	"	3	R9-11		
6	" -0103	" 10K " "	"	1	R2		
7							
8	0126-R6K0	" CHIP 6K	"	2	C6,8		
9							
10	0220-0475	CAPACITOR 4.7MF 35V	"	7	C3,14-17,22,23		
11	0225-0330	" 33PF	"	3	C10-12		
12	" -0221	" 220PF	"	2	C1,2		
13	" -0331	" 330PF	"	2	C9,13		
14	0221-0685	" 6.8 μf 35V	"	1	C26		
15	0226-0104	" .1MF 10V	"	5	C18-21,24		
16							
17							
18							
19	0301-7H03	IC SN74H03N	"	1	F10		
20	" -7H06	" SN74H06N	"	1	* D4		
21	" -7123	" SN74123N	"	2	* B11, D5		
22	" -7156	" SN74156N	"	2	* C5,7		
23	" -7157	" SN74157N	"	3	* C4, D7, E7		
24	" -7192	" SN74192N	"	7	* B5-10, E4		
25	" -7194	" SN74194N	"	1	* C2		
26	" -7400	" N7400A	"	3	A11, D2, 10		

NOTES:

DATE: 10-16-74
DRAWN: GAE
CHK:

MATERIAL LIST

Datum Inc.

JOB NO:
QUANTITY:
TITLE: 1816 BASIC
ASS'Y NO: 16543-36

REV E
SHT 2 OF 2

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	EXT TOTAL
27	0301-7404	IC N7404A	DATUM	1	D3		
28	" -7408	" N7408A	"	3	D9, F8, 9		
29	" -7410	" N7410A	"	1	D11		
30	" -7411	" N7411A	"	1	C9		
31	" -7425	" SN7425N	"	1	E8		
32	" -7432	" SN7432N	"	1	D6		
33	" -7442	" N7442B	"	1	E6		
34	" -7473	" N7473A	"	1	E10		
35	" -7474	" SN7474N	"	2	E9, F11		
36	" -7486	" N7486A	"	2	C3, D8		
37	" -7176	" 74176	"	5	E5, F4-7		
38	" -7177	" 74176	"	2	C10, E11		
39	" -7122	" SN74122	"	1	C11		
40	" -9374	" 9374DC	"	6	A5-10		
41							
42							
43							
44	1301-0001	OSCILLATOR 1MHz	"	1	Y1		
45							
46	1708-3897	SOCKET 14P W/W	"	27			
47	" -3898	" 16P "	"	23			
48							
49	2310-1591-B	MTG BLOCK	"	2			
50							
51	1709692E	PC BOARD	"	1			

NOTES:

DATE: 10-16-74
DRAWN: IC
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY

REV

TITLE: LED DISPLAY (SMH)

ASS'Y NO: 16549

SHT 1 OF 1

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
1	1708-0036	BOARD JOINER	DATUM	2			
3	" -3788	SKT	"	6			
5	2205-0006	LED	"	6	DS4-9		
7	170937 B	P.C. BD STK	"	1			

NOTES:

DATE: 3-28-74
DRAWN: QHE
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY:

REV: A

TITLE: GROUP BINARY CONV.

ASS'Y NO: 16737-1

SHT 1 OF 1

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.				REF. DES.	UNIT COST	LOT TOTAL	
1	0102-0102	RESISTOR 1K 1/4W 5%	DATUM	1				R1			
2	" -0152	" 1.5K " "	"	1				R2			
3											
4	0212-0104	CAPACITOR .1MF 100V	"	2				C3,4			
5	0220-0475	" 4.7MF 35V	"	3				C1,2,5			
6	0225-0121	" 120PF	"	1				C6			
7											
8	0301-7583	IC SN74LS83N	"	3				* A5,7,17			
9	0302-LS08	" 74LS08	"	2				A6,18			
10	0301-7480	" SN7480N	"	4				A3,4,15,16			
11	" -74LS197	" 74LS197	"	3				A1,13,14			
12	0302-LS04	" 74LS04	"	1				A2			
13											
14	1708-3897	SOCKET 14P W/W	"	10							
15	" -3898	" 16P "	"	3				*			
16											
17	170202A	PC BOARD STK	"	1							

NOTES:

DATE: 7-21-87
DRAWN: SATINDER
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY
TITLE: IRIG ENCODER

REV: C

ASS'Y NO: 16062-2

SHT 1 OF 2

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.				REF. DES.	UNIT COST	LOT TOTAL	
1	0102-0100	RESISTOR 10 OHM 1/4W 5%	DATUM	2				R26, 27			
2	0102-0510	" " 51 OHM " "	""	1				R25			
3	0102-0222	" " 2.2 K " "	""	2				R1, 13			
4											
5	0102-0332	" " 3.3 K " "	""	1				R3			
6	0102-0472	" " 4.7 K " "	""	1				R12			
7	0102-0103	" " 10 K " "	""	5				R2, 11, 16, 18, 19			
8	0102-0473	" " 47 K " "	""	3				R6, 10, 14			
9	0102-0104	" " 100 K " "	""	1				R20			
10	0115-5111	" " 5.11 K " 1%	""	1				R8			
11	0115-2262	" " 22.6 K " "	""	3				R4, 5, 9			
12	0154-5001	RESISTOR POT 5K	""	2				R15, 17			
13	0154-2002	RESISTOR POT 20K	""	1				R7			
14	0201-0221	CAPACITOR 220 Pf	""	1				C10			
15	0212-0222	" " .0022 Mf 100V	""	2				C6, 8			
16	0212-0223	" " .022 Mf 100V	""	2				C7, 9			
17	0220-0475	" " 4.7 Mf 35V	""	3				C1, 3, 5			
18											
19	0226-0104	" " .1 Mf 10V	""	2				C2, 4			
20	0226-0104-1	" " .1 Mf 100V	""	2				C11, 12			
21											
22	0301-5558	IC LM 1458N	""	2				A17, 18			
23	0302-LS10-7	IC SN74LS107N	""	1				A7			
24	0301-7151	IC SN74151N	""	5			*	A9, 12-15			
25	0301-7400	IC N7400A	""	2				A2, 3			
26	0301-7408	IC N7408A	""	3				A1, 4, 16			

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO A19506

DATE: 7-21-87
DRAWN: SATINDER
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY

REV C

TITLE: IRIG ENCODER

ASS'Y NO: 16062-2

SHT 2OF2

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.				REF. DES.	UNIT COST	LOT TOTAL	
27	0301-7411	IC N7411A	DATUM	1				A5			
28	0301-7432	IC SN7432N	""	2				A6, 8			
29											
30											
31											
32											
33											
34	0570-1087	TRANSISTOR P1087E	DATUM	1				Q1			
35											
36	1706-2010	TERMINAL	""	4				TP1-4			
37	1708-2034	SOCKET 8P	""	2							
38	1708-3897	SOCKET 14P W/W	""	9							
39	1708-3898	SOCKET 16P W/W	""	6			*				
40											
41	170518A	P. C. BOARD STK	""	1							

NOTES:

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A19506

DATE: 11-14-74
DRAWN: RGE
CHK:

PARTS LIST

TITLE: POWER SUPPLY

datum inc.

JOB NO:
QUANTITY

REV F

ASS'Y NO: 16280-3

SHT 1 OF 3

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
1	0102-0220	RESISTOR 22 OHM 1/4W 5%	DATUM	1	R4		
2	0102-0680	RESISTOR 68 OHM " "	"	2	R2, 12		
3	0102-0101	RESISTOR 100 OHM " "	"	1	R13		
4	0102-0332	RESISTOR 3.3 K " "	"	1	R11		
5	0102-0472	RESISTOR 4.7 K " "	"	1	R1		
6	0102-0682	RESISTOR 6.8 K " "	"	1	R9		
7	0102-0473	RESISTOR 47 K " "	"	2	R5, 6		
8	0102-0754	RESISTOR 750 K " "	"	1	R3		
9							
10	0125-0R10	RESISTOR .1 OHM 3W "	"	1	R7		
11	0154-1001	RESISTOR POT 1K	"	1	R10		
12							
13	0212-0223	CAPACITOR .022 Mf 100V	"	1	C6		
14	0219-0588	CAPACITOR 5800 Mf 40V	"	1	C1		
15	0220-0475	CAPACITOR 4.7 Mf 35V	"	2	C10, 11		
16	0220-0476	CAPACITOR 47 Mf "	"	2	C4, 9		
17	0220-0106-1	CAPACITOR 10 Mf "	"	1	C8		
18	0226-0103	CAPACITOR .01 Mf	"	2	C101, 102		
19	0226-0104	CAPACITOR .1 Mf 10V	"	2	C5, 7		
20							
21	0301-7815	I. C. 7815UC	"	1	A3		
22	0301-7915	I. C. 7915UC	"	1	A2		
23	0301-9305	I. C. LM305H	"	1	A1		
24							
25	0500-0306	DIODE IN914A	"	1	CR3		
26	0515-0752-1	DIODE IN752A	"	1	CR5		

NOTES:

DATE: 11-14-74
DRAWN: RGE
CHK:

PARTS LIST

datum inc.

JOB NO:
QUANTITY

REV F

TITLE: POWER SUPPLY

ASS'Y NO: 16280-3

SHT 2 OF 3

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
27	0540-0106-1	DIODE MCR106-1	DATUM	1	CR6		
28	0540-0447	DIODE VS447	"	1	CRS1		
29	0540-0820	DIODE MR820	"	1	CR2		
30	0540-4720-1	DIODE MR501	"	1	CR1		
31	0540-4934	DIODE IN4934	"	2	CR7, 8		
32							
33	0550-035A	TRANSISTOR TIP-35A	"	1	Q1		
34	0550-7705	TRANSISTOR 2N3565	"	1	Q4		
35	0555-6005	TRANSISTOR 2N2905A	"	1	Q2		
36	0555-6600	TRANSISTOR 2N3645	"	1	Q3		
37							
38	0601-6045	CHOKE	"	1	L1		
39	0601-6082	TRANSFORMER	"	1	T1		
40							
41	0702-0010	FUSE 1A S/B 3AG	"	1	F1		
42							
43	0750-0200	FUSE HOLDER	"	1	XF1		
44							
45	1704-1061-1	CONNECTOR AC	"	1			
46							
47	1706-0033	EYELET	"	2	(L1)		
48	1708-3897	SOCKET 14P W/W	"	1			
49	1708-8000	SOCKET 8P	"	1	XA1		
50							
51							
52	2310-1247-09	STANDOFF #6 x 1/8	"	1	(L1)		

NOTES:

DATE: 11-14-74
DRAWN: RGE
CHK:

PARTS LIST

datum inc.

JOB NO:
QUANTITY

REV F

TITLE: POWER SUPPLY

ASS'Y NO: 16280-3

SHT 3 OF 3

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.	REF. DES.	UNIT COST	LOT TOTAL
53	2325-1004	TOROID RETAINER	DATUM	1	(L1)		
54							
55	704561	MOUNTING PLATE STK	"	1			
56	704562	SIDE BRACKET STK	"	1			
57	704966-1	MOUNTING BRACKET STK	"	1			
58	704966-2	MOUNTING BRACKET STK	"	2			
59							
60	707350	HEAT SINK STK	"	1			
61							
62	170778E	P. C. BOARD STK	"	1			
63	170779C	P. C. BOARD STK	"	1			
64							
65							
66	120-4	TOROID RETAINER	DELBERT BLINN	1	(L1) M/S		

NOTES:

DATE: 7.21.87
DRAWN: SATINDER
CHK:

MATERIAL LIST

TITLE: PARALLEL OUTPUTS

datum inc.

JOB NO:
QUANTITY

REV: A

ASS'Y NO: 16669-456

SHT 1 OF 1

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.					REF. DES.	UNIT COST	LOT TOTAL	
1	0102-0222	RESISTOR, 2.2K, 1/4W, 5%	DATUM	1					R1			
2	" -0103	" 10K " "	"	1					R3			
3												
4	0220-0475	CAPACITOR 4.7uf @ 35V	"	2					C1,3			
5	0225-0471	" 470 pf @ 100V	"	1					C7			
6	0226-0103-1	" .01uf "	"	1					C6			
7	" -0104	" .1uf @ 10V	"	2					C2,4			
8												
9	0301-7123	I.C. SN74123N	"	1				*	A1			
10	" - 7408	" N7408A	"	9					A8,9-11,20-23,2			
11												
12	1704-0036	CONNECTOR 36P	"	1					J5			
13												
14	1708-3897	SOCKET 14P W/W	"	9								
15	" -3898	" 16P "	"	1				*				
16												
17	703336	CONN PLATE STK	"	1								
18												
19	171112 N/C	P.C. BD. STK.	"	1								

NOTES:

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DATE: 2-1-77
DRAWN: R. FLOCK
CHK:

MATERIAL LIST

datum inc.

JOB NO:
QUANTITY

REV A

TITLE: C/F DECODER

ASS'Y NO: 1708Z

SHT 1 OF 1

ITEM	STOCK/PART NO.	DESCRIPTION	MFR/SPEC	QTY.				REF. DES.	UNIT COST	LOT TOTAL	
1	0102-0202	RESISTOR, 2K, 1/4W, 5%	DATUM	1				R1			
2											
3	0212-0103	CAPACITOR .01uf@100V	"	1				C5			
4	0220-0475	" 4.7uf@35V	"	2				C1,4			
5	0226-0104	" .1uf@10V	"	2				C2,3			
6											
7	0301-7174	I.C. SN74174N	"	3			*	E2, F2, H2			
8	" -7194	" SN74194N	"	4			*	A2, B2, C2, D2			
9	" -7408	" N7408A	"	2				F1, H1			
10	" -7411	" SN7411N	"	1				D1			
11	" -7427	" SN7427N	"	1				C1			
12	" -7432	" N7432A	"	1				E1			
13	" -7442	" N7442A	"	2			*	A1, B1			
14											
15	1708-3897	SKT 14P W/W	"	5							
16	" -3898	" 16P "	"	9			*				
17											
18	0801-1169	P.C. BD.	"	1							
19											
20	804572	WIRELIST	"	REF							

NOTES:

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APPENDIX A

TIME CODE FORMATS

The time code formatting data in this Appendix is included for reference purposes only. The actual code either generated or translate by the Model 9300 TCG/T may vary substantially from the formats shown herein, depending on customer specifications.

The Manual Addendum, located immediately behind the title page and entitled "EQUIPMENT CONFIGURATION" defines any deviations from standard formats.

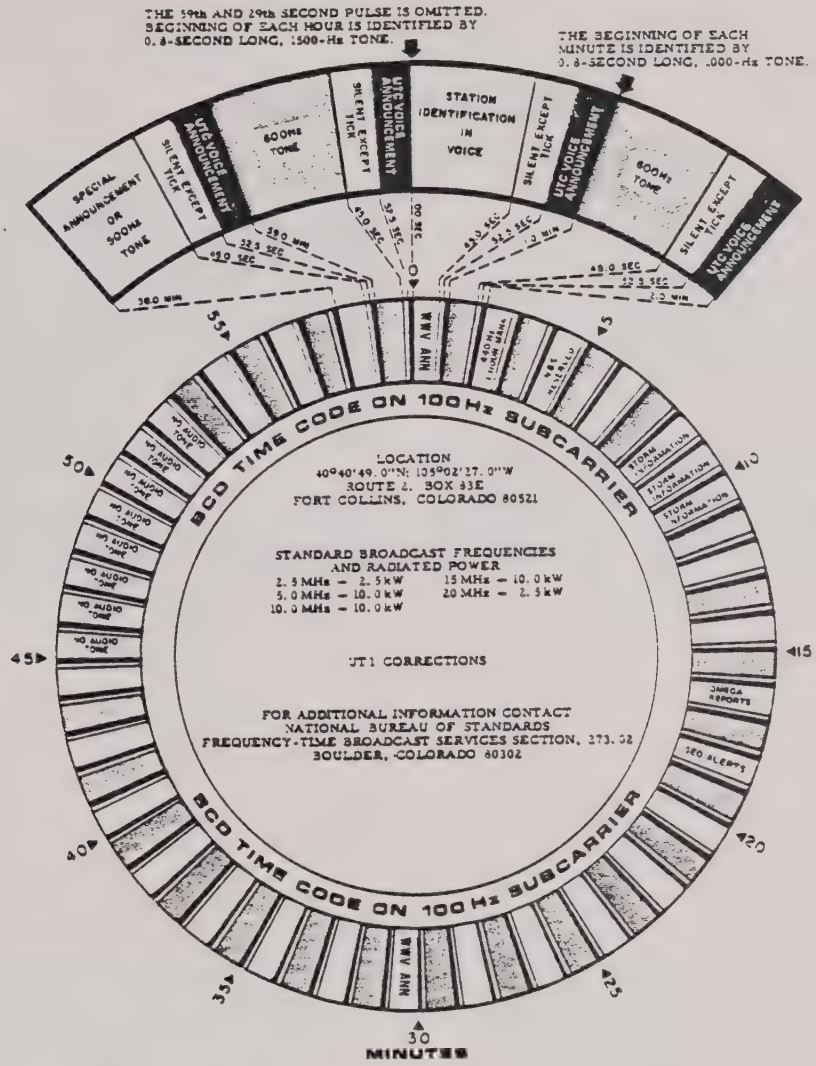
GLOSSARY OF TERMS

ACCURACY (CODE)	The correctness of CODE DIGIT WEIGHTING
BINARY NUMBER SYSTEM	A number system which uses two symbols, usually denoted by "0" and "1", and has two as its base. Not to be confused with CODE DIGIT WEIGHTING
CODE DIGIT	One of a definite set of ELEMENTS, the set comprising a CODE WORD. Each code digit is individually and numerically weighted
CODE DIGIT WEIGHTING	The numerical value assigned to a particular CODE DIGIT position
CODE WORD (TIME)	A definite set of ELEMENTS which collectively convey information defining an instant of time
ELEMENT	One of the parts of which any time signal is composed
FORMAT	The arrangement of ELEMENTS within a group
INDEX COUNT	The number which identifies a specific ELEMENT position with respect to a REFERENCE MARKER
INSTRUMENTATION TIMING	A parameter serving as the fundamental independent variable in terms of which data may be correlated
INDEX MARKERS	Uncoded periodic interpolating ELEMENTS
ON TIME	The state of any ELEMENT being coincident with the STANDARD REFERENCE TIME
POSITION IDENTIFIER	An ELEMENT denoting the position of a portion or all of a CODE WORD
PULSE	A variation of a quantity whose value is normally constant; the variation is characterized by a "rise" and a "decay" and has a finite "duration"
REFERENCE MARKER	A periodic combination of ELEMENTS which establishes that instant of time defined by the CODE WORD
SECOND	The basic unit of TIME
TIME INTERVAL	Time interval indicates the duration of a segment of time without reference to when the time interval begins and ends
STANDARD REFERENCE TIME	The basic repetition rate chosen as the common time reference for all other INSTRUMENTATION TIMING. (usually 1 pps)
TIME	Time signifies epoch; that is, the designation of an instant on a selected time scale and is used in the sense of TIME of day
TIME CODE ZERO (T_{co})	The instant of time defined by all CODE WORDS as zero. It is derived from and coincident with an ELEMENT of the STANDARD REFERENCE TIME
TIME FRAME	The TIME INTERVAL between consecutive REFERENCE MARKERS containing all ELEMENTS of a time FORMAT.

ABBREVIATIONS

PDM	PULSE DURATION MODULATION
PWM	PULSE WIDTH MODULATION
TCW	TIME CODE WORD
TOD	TIME OF DAY
Hz	An abbreviation for HERTZ. The derived unit of frequency (cycles per second).
kHz	KILOHERTZ (1000 HERTZ)
ppm	PULSES PER MINUTE
pps	PULSES PER SECOND
ms	MILLISECOND (0.001 second)
μs	MICROSECOND (0.000001 second)
fph	FRAMES PER HOUR
fpm	FRAMES PER MINUTE
fps	FRAMES PER SECOND
UTC	UNIVERSAL TIME COORDINATED. (The U.S. Naval Observatory is responsible for maintaining the reference for time and time interval for the Department of Defense per DOD Directive 5160.51, 1 Feb. 1965.)
BCD	BINARY CODED DECIMAL
CF	CONTROL FUNCTION
SBS	STRAIGHT BINARY SECONDS
STOD	SECONDS TIME OF DAY
BIT	BINARY DIGIT
LSB	LEAST SIGNIFICANT BIT
MSB	MOST SIGNIFICANT BIT
PAM	PULSE AMPLITUDE MODULATION
PWC	PULSE WIDTH CODED

WWV BROADCAST FORMAT (TYPICAL)



The National Bureau of Standards maintains three radio stations whose function it is to transmit standard time broadcasts for laboratories and individual users throughout the world. Radio stations WWV and WWVH are high frequency broadcast stations on carrier frequencies of: 2.5 MHz, 5 MHz, 10 MHz and 20 MHz. WWV additionally broadcasts on 25 MHz (see Appendix 'A'). In addition to the two high-frequency radio stations, Radio Station WWVB broadcasts serial time codes at a 60 kHz transmission carrier for accurate frequency measurements within the continental United States.

Radio Stations WWV and WWVH have, in addition to serial Time Codes, voice time announcements and special voice announcements as required, as well as various tone signals. A precise one-second "tick" is also broadcast by both WWV and WWVH for audio determination of Epoch and period time synchronization.

The time being broadcast by WWV, WWVH and WWVB is Universal Time Coordinated (see Appendix 'B') and is maintained to the internationally-agreed time by one-second corrections. Further, the code formats provided by each station provide coded information to enable determination of Universal Time (UTI).

The serial time codes (as part of the radio transmissions) are shown and described on the following pages. Additional information regarding the broadcasts, as well as definitions and user data, is available in Appendix 'B' of this Handbook and available from the National Bureau of Standards, Frequency-Broadcast Services Station 273.02, Boulder, Colorado 80302.

INTER-RANGE INSTRUMENTATION GROUP
STANDARD INSTRUMENTATION TIMING FORMATS

General

In the early 1950s it became apparent that efficient interchange of test data between the various test ranges and contractor, university and Government laboratories would require time code standardization. This task of standardization was assigned to the Tele-Communications Working Group (TCWG) of the IRIG in October of 1956. The original IRIG standards were accepted by the Steering Committee in 1960. IRIG publication No. 104-60 defined the original IRIG Formats. This document was later revised and then reprinted in August, 1970 as Document No. 104-70. More information regarding the efforts of IRIG and the availability of IRIG standards can be gained by contacting the Secretariat, Range Commander's Council, White Sands Missile Range, New Mexico 88002. More detail concerning the individual range synchronization and instrumentation timing can be obtained by referring to IRIG Document 103-59, "Instrumentation Timing Systems" brochure.

Description of Formats

In the IRIG family, individual Time Code Formats are alphabetically designated 'A', 'B', 'D', 'E', 'G' and 'H'. These are defined in IRIG Document No. 104-70. IRIG 'C', originally defined in IRIG Document No. 104-60, has been eliminated and effectively replaced by IRIG 'H'. Various signal forms are described in the IRIG Document. Identification numbers have been developed in accordance with the following procedure.

Rate Designation:
- A) 1000 pps
- B) 100 pps
- D) 1 ppm
- E) 10 pps
- G) 10000 pps
- H) 1 pps

Form Designation:
- 0) Pulse, width-coded
- 1) Sine wave, amplitude-modulated

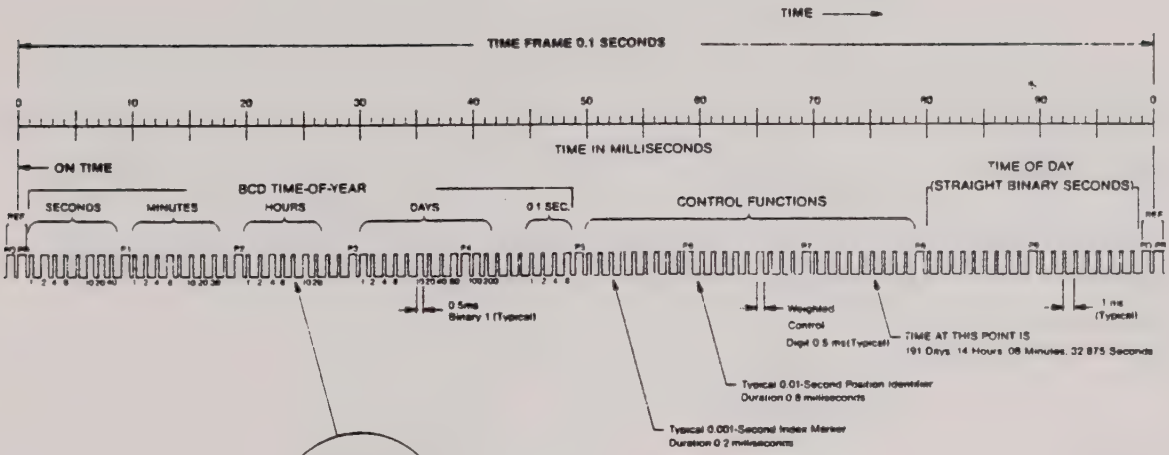
Carrier/Resolution:
- 0) No carrier/index count interval
- 1) 100 Hz/10 ms
- 2) 1000 Hz/1 ms
- 3) 10000 Hz/0.1 ms
- 4) 100000 Hz/0.01 ms

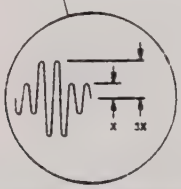
Coded Expressions:
- 0) BCD, CF, SBS
- 1) BCD, CF
- 2) BCD
- 3) BCD, SBS

Only the following signals are recognized to be standard forms in accordance with the IRIG standard:

Format A	Format B	Format D	Format E	Format G	Format H
A000	B000	D001	E001	G001	H001
A003	B003	D002	E002	G002	H002
A130	B120	D111	E111	G141	H111
A133	B123	D112	E112	G142	H112
		D121	E121		H121
		D122	E122		H122

IRIG FORMAT 'A'—GENERAL



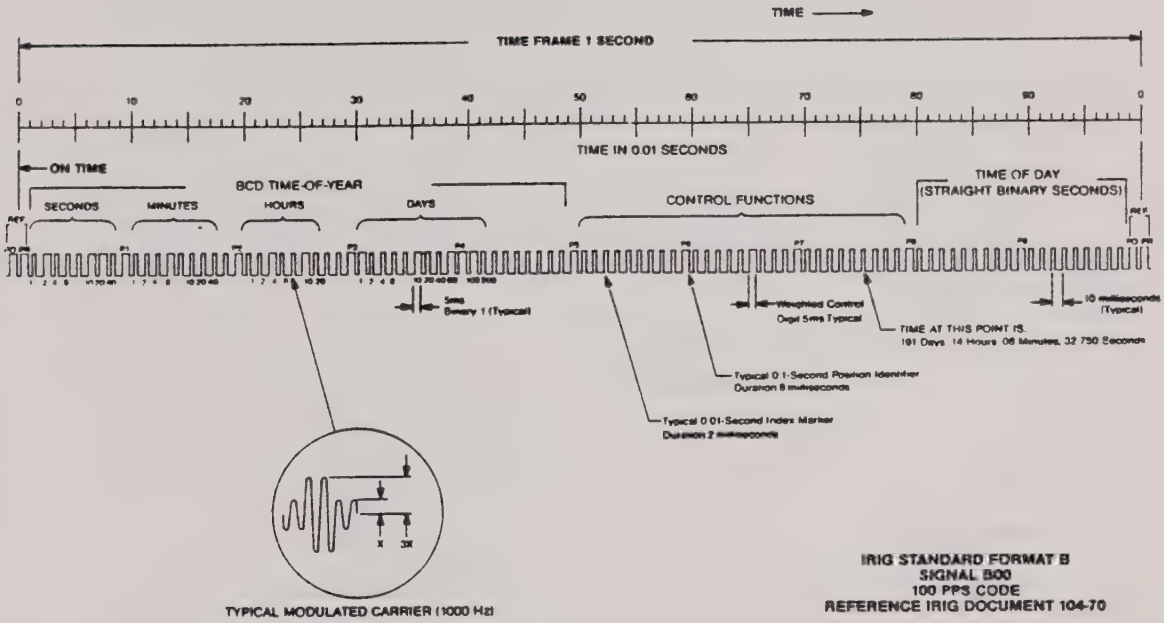


TYPICAL MODULATED CARRIER (10000 Hz)

IRIG STANDARD FORMAT A
SIGNAL A00
1000 PPS CODE
REFERENCE IRIG DOCUMENT 104-70

1. **TIME FRAME:** 0.1 second
2. **CODE DIGIT WEIGHTING OPTIONS:** BCD, SB or both:
   a. Binary Coded Decimal Time-of-Year CODE WORD — 34 binary digits.
      (1) Seconds, minutes, hours, days and 0.1 seconds. Recycles yearly.
   b. Straight Binary Time-of-Day CODE WORD — 17 binary digits.
      (1) Seconds only. Recycles each 24 hours. (86399)
3. **CODE WORD STRUCTURE:**
   a. **BCD.** Word begins at INDEX COUNT 1. Binary-coded elements occur between POSITION IDENTIFIER ELEMENTS (seven for seconds; seven for minutes; six for hours; ten for days; four for 0.1 seconds) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
   b. **SB.** Word begins at INDEX COUNT 80. Seventeen binary-coded elements occur, with a POSITION IDENTIFIER between the 9th and 10th binary-coded elements.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first, except for fractional seconds information, which occurs following the day-of-year information.
5. **ELEMENT RATES AVAILABLE:**
   a. 1000 per second (basic Element rate)
   b. 100 per second (POSITION IDENTIFIER rate)
   c. 10 per second (Frame rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its leading edge.
   b. INDEX MARKER duration: 0.2 milliseconds (Binary Zero or uncoded Element)
   c. CODE DIGIT duration: 0.5 milliseconds (Binary one)
   d. POSITION IDENTIFIER: 0.8 milliseconds
   e. REFERENCE MARKER: Two consecutive POSITION IDENTIFIERS.
      (The "on-time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 1 millisecond (unmodulated); 0.1 millisecond (modulated)
8. **CARRIER FREQUENCY:** 10 kHz when modulated.

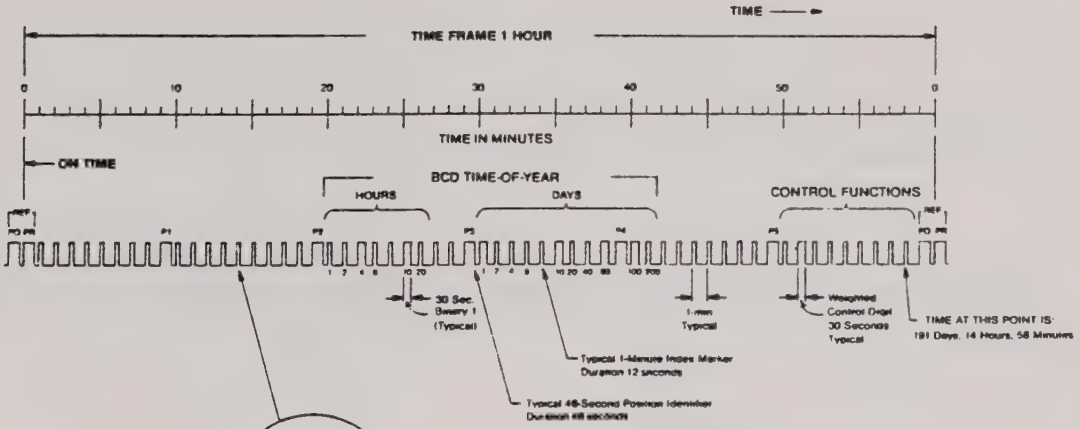
IRIG FORMAT 'B' — GENERAL



IRIG STANDARD FORMAT B
SIGNAL B00
100 PPS CODE
REFERENCE IRIG DOCUMENT 104-70

1. **TIME FRAME:** 1.0 second.
2. **CODE DIGIT WEIGHTING OPTIONS:** BCD, SB or both:
   a. Binary Coded Decimal Time-of-Year CODE WORD — 30 binary digits.
      (1) Seconds, minutes, hours and days. Recycles yearly.
   b. Straight Binary Time-of-Day CODE WORD — 17 binary digits.
      (1) Seconds only. Recycles each 24 hours. (86399)
3. **CODE WORD STRUCTURE:**
   a. **BCD:** Word begins at INDEX COUNT 1. Binary-coded elements occur between POSITION IDENTIFIER ELEMENTS (seven for seconds, seven for minutes; six for hours; ten for days) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
   b. **SB:** Word begins at INDEX COUNT 80. Seventeen binary-coded elements occur with a POSITION IDENTIFIER between the 9th and 10th binary-coded elements.
4. **LEAST SIGNIFICANT DIGIT:** occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 100 per second (basic Element rate)
   b. 10 per second (POSITIVE IDENTIFIER Rate)
   c. 1 per second (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its leading edge.
   b. INDEX MARKER duration: 2 milliseconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 5 milliseconds (Binary one)
   d. POSITION IDENTIFIER duration: 8 milliseconds
   e. REFERENCE MARKER — one per second: Two consecutive POSITION IDENTIFIERS
      (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 10 milliseconds (unmodulated); 1 millisecond (modulated)
8. **CARRIER FREQUENCY:** 1 kHz when modulated.

IRIG FORMAT 'D' – GENERAL

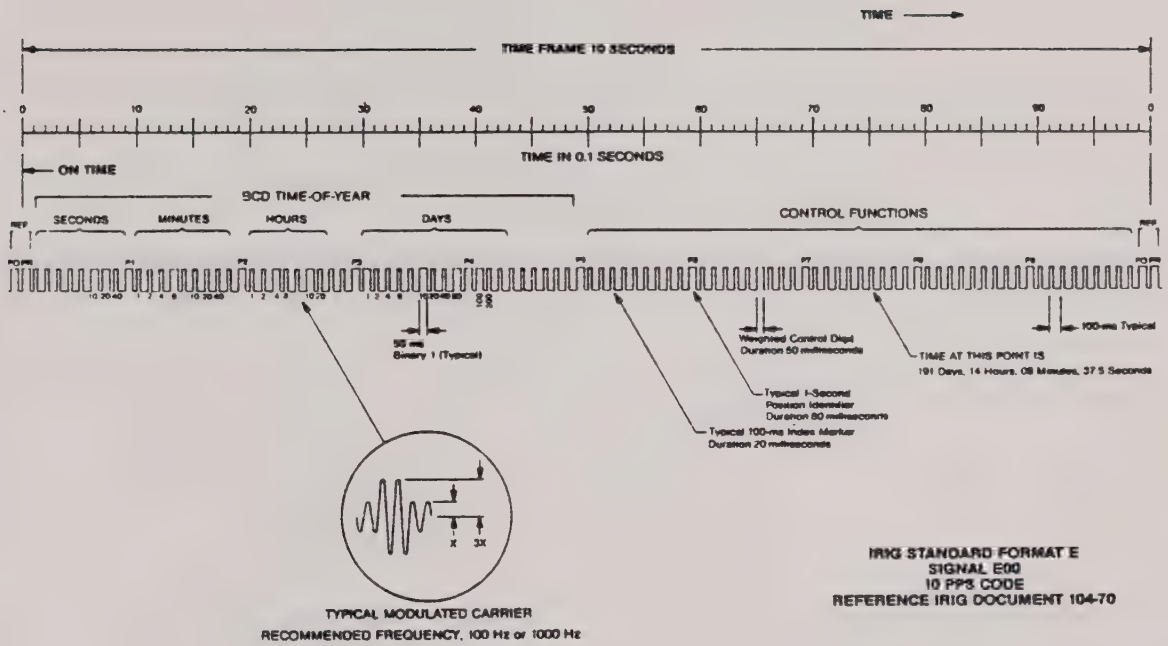


TYPICAL MODULATED CARRIER
RECOMMENDED FREQUENCY, 100 Hz or 1000 Hz

IRIG STANDARD FORMAT D
SIGNAL D00
1 PPM CODE
REFERENCE IRIG DOCUMENT 104-70

1. **TIME FRAME:** 1 hour
2. **CODE DIGIT WEIGHTING OPTIONS:** Binary Coded Decimal Time-of-Year CODE WORD only — 16 binary digits.
   a. Hours and days. Recycles yearly.
3. **CODE WORD STRUCTURE:**
   a. **BCD:** Word begins at INDEX COUNT 20. Binary-coded elements occur between POSITION IDENTIFIER ELEMENTS (six for hours; ten for days) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per minute (basic Element rate)
   b. 1 per 10 minutes (POSITION IDENTIFIER Rate)
   c. 1 per hour (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its leading edge.
   b. INDEX MARKER duration: 12 seconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 30 seconds (Binary one)
   d. POSITION IDENTIFIER (one per 10 minutes) duration: 48 seconds (Refers to the leading edge of the succeeding Element).
   e. REFERENCE MARKER (one per hour). Two consecutive POSITION IDENTIFIERS
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 1 minute (unmodulated), 0.01 seconds (modulated 100 Hz); 0.001 seconds (modulated 1000 Hz)
8. **CARRIER FREQUENCY:** 100 or 1000 Hz when modulated.

IRIG FORMAT 'E' – GENERAL

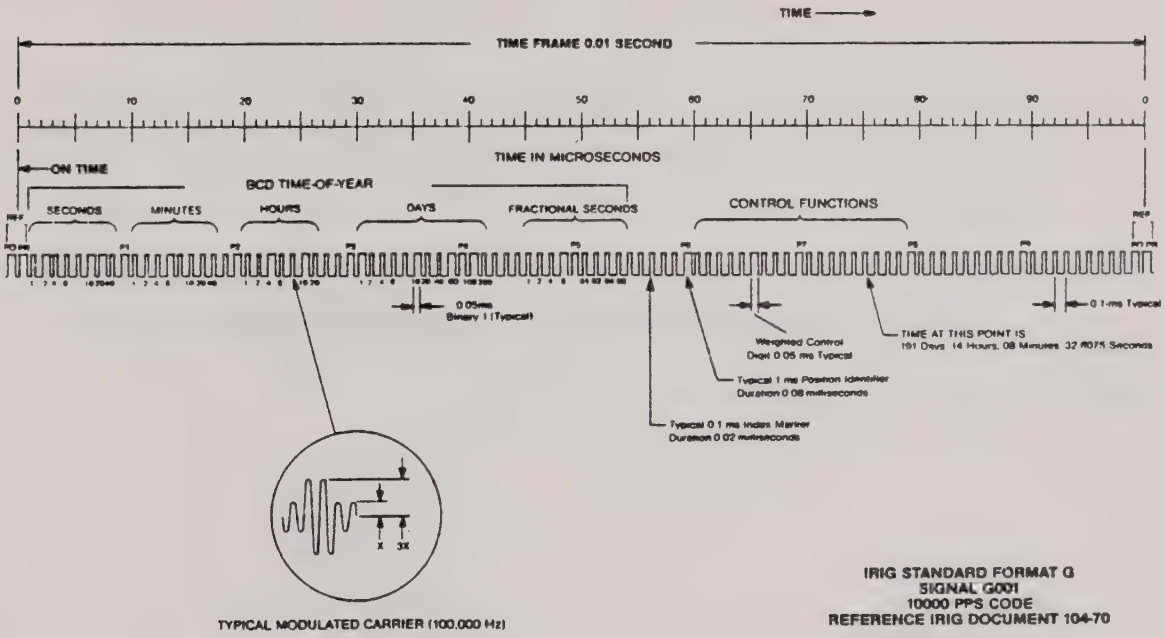


IRIG STANDARD FORMAT E
SIGNAL E00
10 PPS CODE
REFERENCE IRIG DOCUMENT 104-70

1. **TIME FRAME:** 10 seconds
2. **CODE DIGIT WEIGHTING:** BCD: Time-of-Year CODE WORD – 26 Binary Digits. Seconds, minutes, hours and days; recycles yearly
3. **CODE WORD STRUCTURE:**
   BCD: Word begins at INDEX COUNT 6. Binary-coded Elements occur between POSITION IDENTIFIER ELEMENTS (three for seconds, seven for minutes; six for hours, ten for days) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 10 per second (basic Element rate)
   b. 1 per second (POSITION IDENTIFIER Rate)
   c. 0.1 per second (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its leading edge.
   b. INDEX MARKER duration: 20 milliseconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 50 milliseconds (Binary one)
   d. POSITION IDENTIFIER duration: 80 milliseconds (Refers to the leading edge of the succeeding Element).
   e. REFERENCE MARKER (one per 10 seconds): Two consecutive POSITION IDENTIFIERS.

   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 100 milliseconds (unmodulated); 1 millisecond (modulated).
8. **CARRIER FREQUENCY:** 1 kHz or 100 Hz when modulated.

IRIG FORMAT 'G' — GENERAL

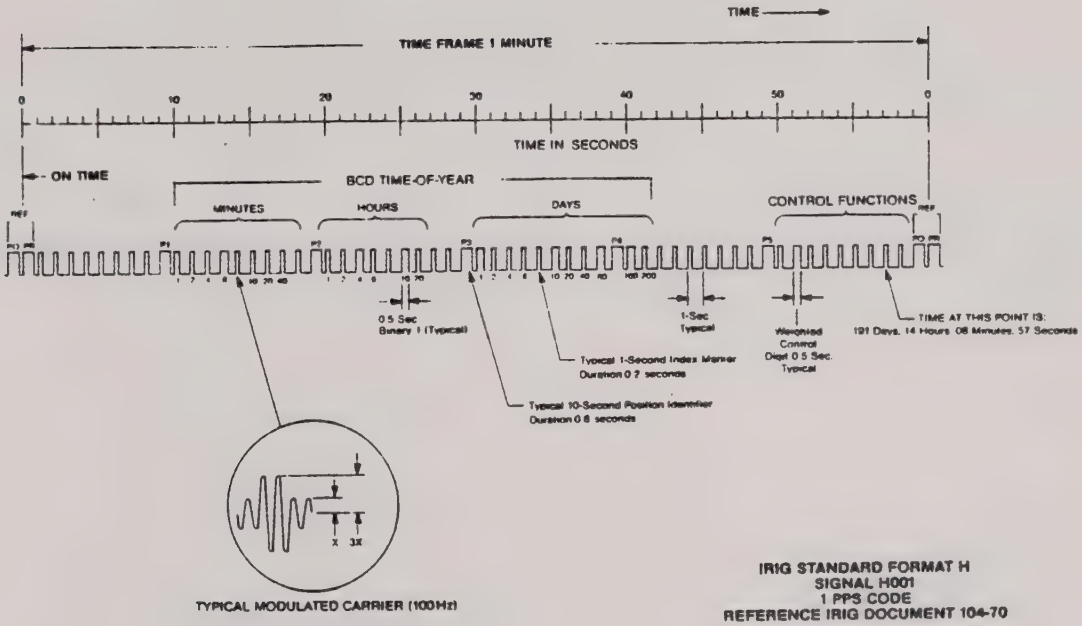


TYPICAL MODULATED CARRIER (100,000 Hz)

IRIG STANDARD FORMAT G
SIGNAL G001
10000 PPS CODE
REFERENCE IRIG DOCUMENT 104-70

1. **TIME FRAME:** 0.01 second.
2. **CODE DIGIT WEIGHTING:** BCD Time-of-Year CODE WORD — 38 binary digits.
   a. Seconds, minutes, hours, days, 0.1 seconds and 0.01 seconds; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD Word begins at INDEX COUNT 1. Binary Coded Elements occur between POSITION IDENTIFIER ELEMENTS (seven for seconds; seven for minutes; six for hours; ten for days; four for 0.1 seconds; four for 0.01 seconds) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first, except for fractional seconds information, which occurs following the Day-of-Year information.
5. **ELEMENT RATES AVAILABLE:**
   a. 10000 per second (basic Element Rate)
   b. 1000 per second (POSITION IDENTIFIER Rate)
   c. 100 per second (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 0.02 milliseconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 0.05 milliseconds (Binary one)
   d. POSITION IDENTIFIER duration: 0.08 milliseconds
   e. REFERENCE MARKER: Two consecutive POSITION IDENTIFIERS.
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 0.10 milliseconds (unmodulated); 0.01 milliseconds (modulated).
8. **CARRIER FREQUENCY:** 100 kHz when modulated.

IRIG FORMAT 'H' — GENERAL

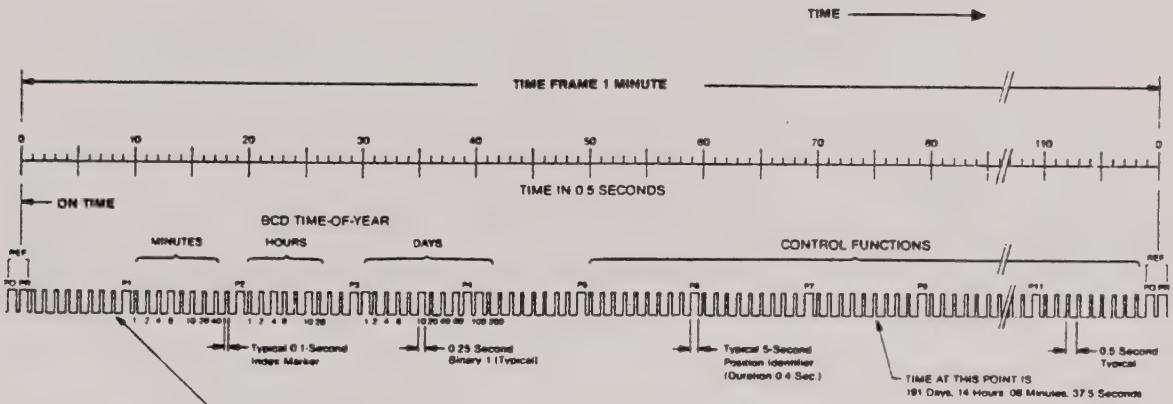


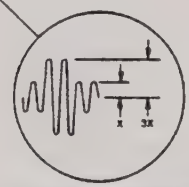
TYPICAL MODULATED CARRIER (100Hz)

IRIG STANDARD FORMAT H
SIGNAL H001
1 PPS CODE
REFERENCE IRIG DOCUMENT 104-70

1. **TIME FRAME:** 1 minute
2. **CODE DIGIT WEIGHTING:** BCD Time-of-Year CODE WORD — 23 binary digits. Minutes, hours and days; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD word begins at INDEX COUNT 10. Binary-Coded Elements occur between POSITION IDENTIFIER ELEMENTS (seven for minutes; six for hours; ten for days) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per second (basic Element Rate)
   b. 1 per ten seconds (POSITION IDENTIFIER Rate)
   c. 1 per minute (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 0.2 seconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 0.5 seconds (Binary one)
   d. POSITION IDENTIFIER duration: 0.8 seconds
   e. REFERENCE MARKER: 1 per minute. Two consecutive POSITION IDENTIFIERS (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 1 second (unmodulated); 0.01 seconds (modulated 100 Hz); 0.001 seconds (modulated 100 Hz).
8. **CARRIER FREQUENCY:** 1 kHz or 100 Hz where modulated.

IRIG FORMAT 'C' — GENERAL (OBSOLETE) HISTORICAL



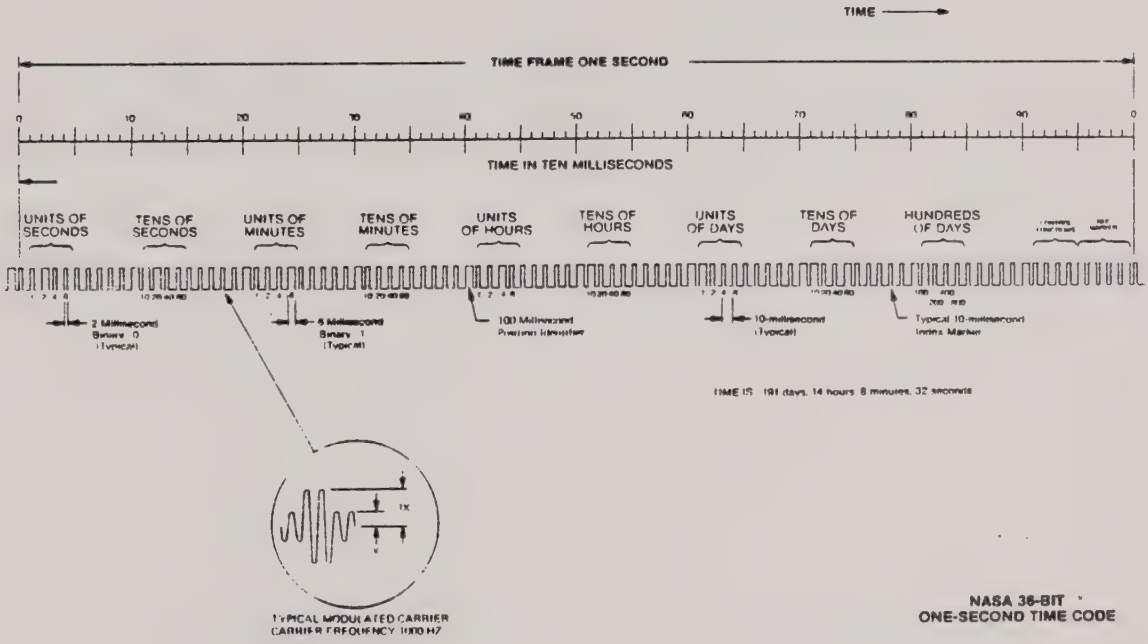


TYPICAL MODULATED CARRIER
(RECOMMENDED FREQUENCY 1000 Hz or 100 Hz)

IRIG STANDARD FORMAT C
2 PPS CODE
(DISCONTINUED)
REFERENCE IRIG DOCUMENT 104-60

1. **TIME FRAME:** 1 minute
2. **CODE DIGIT WEIGHTING OPTIONS:** Binary Coded Decimal Time-of-Year CODE WORD only — 23 binary digits. Minutes, hours and days; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 10. Binary-coded Elements occur between POSITION IDENTIFIER Elements (seven for minutes; six for hours; ten for days) until the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 2 per second (basic Element rate)
   b. 1 per 5 seconds (POSITION IDENTIFIER Rate)
   c. 1 per minute (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its leading edge.
   b. INDEX MARKER duration: 0.1 seconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 0.25 seconds (Binary one)
   d. POSITION IDENTIFIER duration: 0.4 seconds (Refers to the leading edge of the succeeding Element)
   e. REFERENCE MARKER: Two consecutive POSITION IDENTIFIERS.
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER.)
7. **RESOLUTION:** 0.5 seconds (unmodulated); 0.01 seconds (modulated 100 Hz); 0.001 seconds (modulated 1000 Hz).
8. **CARRIER FREQUENCY:** 100 or 1000 Hz when modulated.

NASA 36-BIT TIME CODE (GENERAL)
(NASA 1 SECOND BCD TIME CODE)

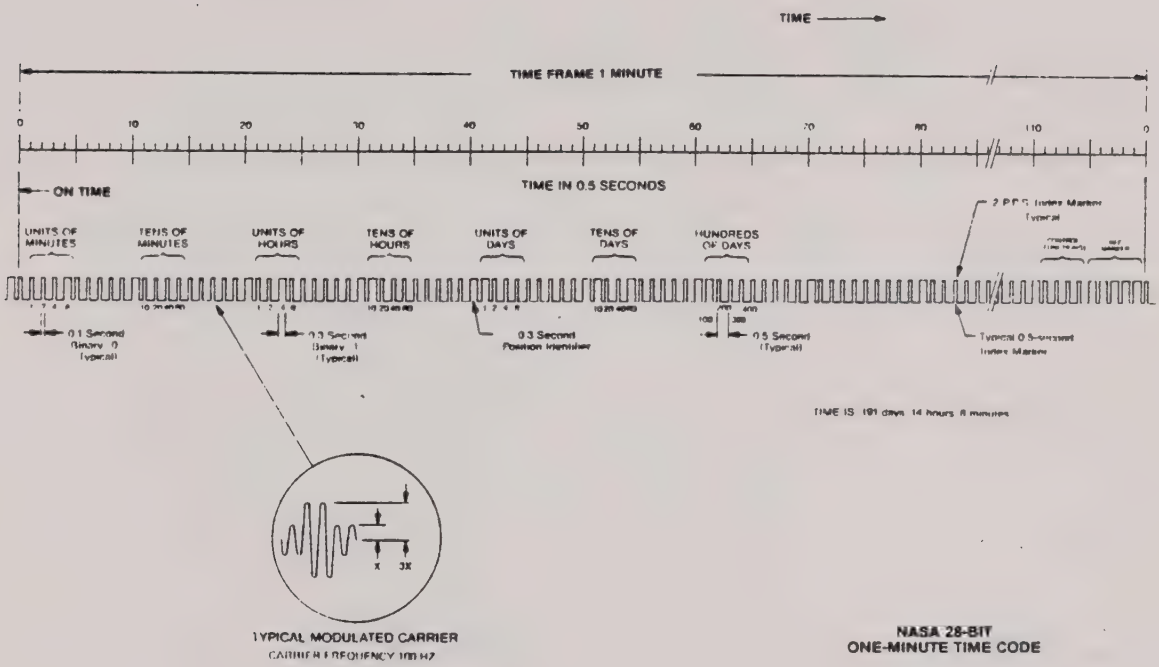


NASA 36-BIT
ONE-SECOND TIME CODE

1. **TIME FRAME:** 1 second
2. **CODE DIGIT WEIGHTING:** Binary Coded Decimal Time-of-Year CODE WORD — 30 binary digits. Seconds, minutes, hours and days; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 1. Binary-Coded Elements occur between POSITION IDENTIFIER ELEMENTS in 4-digit groups until the CODE WORD is complete. A CODE DIGIT occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 100 per second (basic Element Rate)
   b. 1 per second (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 2 milliseconds (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 6 milliseconds (Binary one)
   d. POSITION IDENTIFIER duration: 6 milliseconds
   e. REFERENCE MARKER: Five consecutive POSITION IDENTIFIERS followed by an INDEX MARKER.

   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the INDEX MARKER following the four POSITION IDENTIFIERS.)
7. **RESOLUTION:** 10 milliseconds (unmodulated); 1 millisecond (modulated).
8. **CARRIER FREQUENCY:** 1 kHz when modulated.

NASA 28-BIT TIME CODE (GENERAL)
(NASA 1 MINUTE BCD TIME CODE)

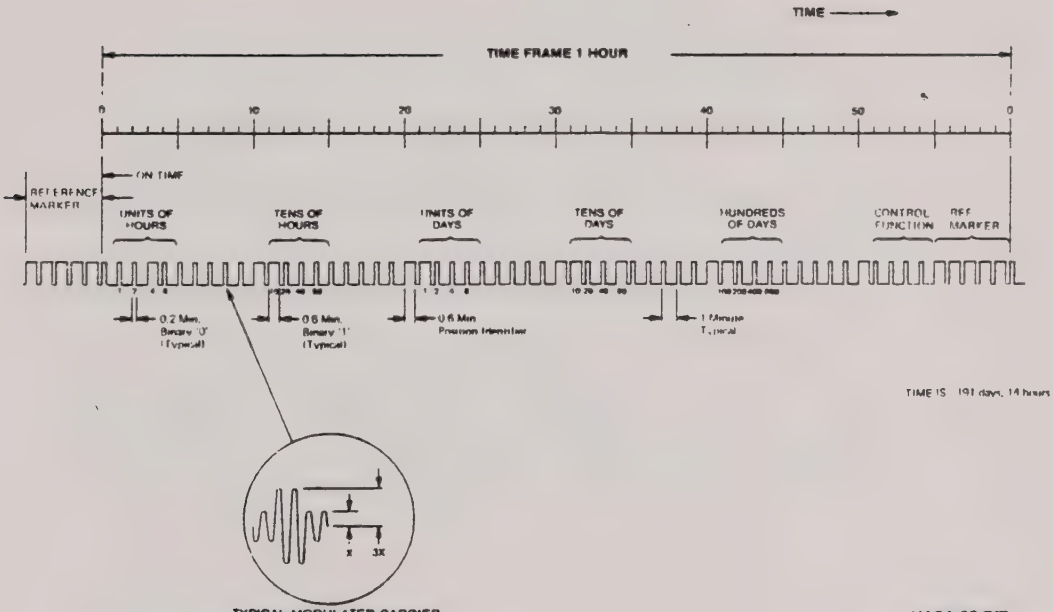


TYPICAL MODULATED CARRIER
CARRIER FREQUENCY 100 HZ

NASA 28-BIT
ONE-MINUTE TIME CODE

1. **TIME FRAME:** 1 minute.
2. **CODE DIGIT WEIGHTING:** Binary Coded Decimal Time-of-Year CODE WORD — 23 binary digits. Minutes, hours and days; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 1. Binary Coded Elements occur between POSITION IDENTIFIER ELEMENTS in four-digit groups until the CODE WORD is complete. A CODE DIGIT occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 2 per second (basic Element Rate)
   b. 1 per minute (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 0.1 second (Binary zero or uncoded Element)
   c. CODE DIGIT duration: 0.3 second (Binary one)
   d. POSITION IDENTIFIER duration: 0.3 second
   e. REFERENCE MARKER: Five consecutive POSITION IDENTIFIERS followed by an INDEX MARKER. (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the INDEX MARKER following the four POSITION IDENTIFIERS.)
7. **RESOLUTION:** 0.5 second (unmodulated); 0.01 second (modulated 100 Hz); 0.001 second (modulated 1000 Hz).
8. **CARRIER FREQUENCY:** 100 Hz or 1000 Hz when modulated.

NASA 20-BIT TIME CODE (GENERAL)
(NASA 1-HOUR BCD TIME CODE)



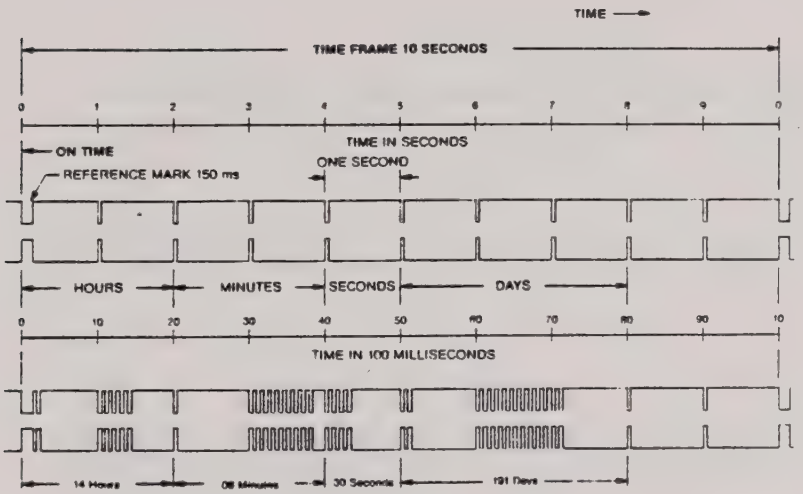
TYPICAL MODULATED CARRIER
(RECOMMENDED FREQUENCY: 100 Hz)

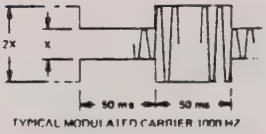
NASA 20-BIT
ONE-HOUR TIME CODE

1. **TIME FRAME:** 1 hour.
2. **CODE DIGIT WEIGHTING:** Binary Coded Decimal Time-of-Year CODE WORD — 16 binary digits. Hours and days; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 1. Binary-coded elements occur between POSITION IDENTIFIER ELEMENTS in four-digit groups until the CODE WORD is complete. A CODE DIGIT occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per minute (basic Element Rate)
   b. 1 per hour (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 0.2 minutes (binary zero or uncoded Element).
   c. CODE DIGIT duration: 0.6 minutes (Binary One)
   d. POSITION IDENTIFIER duration: 0.6 minutes
   e. REFERENCE MARKER: Five consecutive POSITION IDENTIFIERS followed by an INDEX MARKER

   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the INDEX MARKER following the four POSITION IDENTIFIERS).
7. **RESOLUTION:** 1 minute (unmodulated); 10 milliseconds (modulated 100 Hz); 1 millisecond (modulated 1 kHz)
8. **CARRIER:** 100 Hz or 1 kHz when modulated.

NASA SERIAL DECIMAL — SUPPRESSED CARRIER (GEMINI)



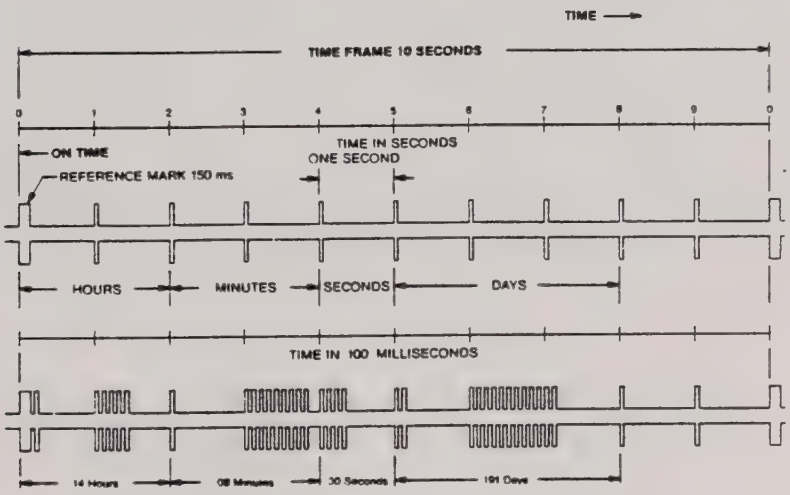


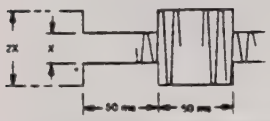
TYPICAL MODULATED CARRIER 1000 HZ

NASA SERIAL DECIMAL CODE — SUPPRESSED CARRIER — (Gemini)

1. **TIME FRAME:** 10 seconds
2. **CODE DIGIT WEIGHTING:** Decimal Time-of-Year CODE WORD. Decimal pulse-coded.
   a. Seconds, minutes, hours and days. A coded pulse is designated by 50 milliseconds of suppressed carrier
3. **CODE WORD STRUCTURE:**
   a. DECIMAL: Word begins at INDEX COUNT 2. Decimal elements occur between POSITION IDENTIFIER ELEMENTS in nine-digit groups until CODE WORD is complete. A Code Digit (50 milliseconds of suppressed carrier) represents one decimal count and is added to accumulate the value of each CODE WORD. An INDEX MARKER occurs between code groups to provide separation for visual resolution.
4. **HOURS CODE WORD:** Occurs first, followed by minutes, seconds and days.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per second (POSITION IDENTIFIER Rate)
   b. 1 per 10 seconds (Frame Rate)
   All other rates are variable depending on code content.
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. CODE DIGIT duration: 50 milliseconds (decimal count of one)
   c. POSITION IDENTIFIER duration: 50 milliseconds
   d. REFERENCE MARKER duration: 150 milliseconds
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the 150-millisecond reference occurring at 1 per 10 seconds).
7. **RESOLUTION:** 1 second (POSITION IDENTIFIER); 10 second (Frame Rate); 1 millisecond (Modulated).
8. **CARRIER:** 1 kHz

NASA SERIAL DECIMAL — EXALTED CARRIER (APOLLO)



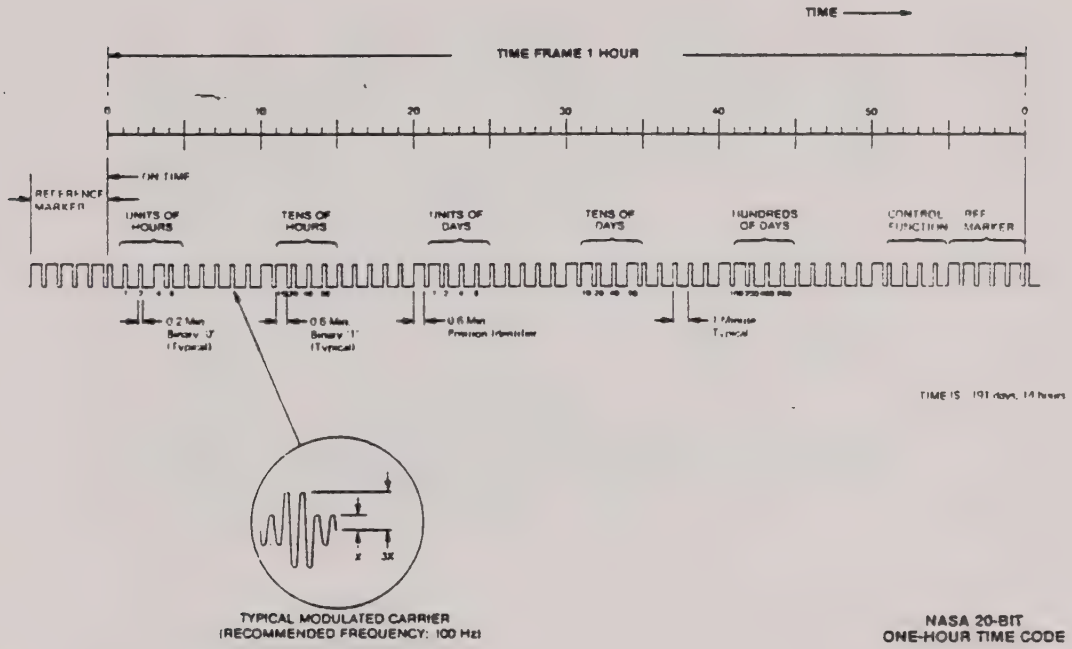


TYPICAL MODULATED CARRIER (1000 Hz)

NASA SERIAL DECIMAL CODE — EXALTED CARRIER — (Apollo)

The Exalted Carrier form of NASA serial decimal Time Code is exactly equal to the Suppressed Carrier format. The only difference lies in the method of modulating the 1000 Hz sinewave.

NASA 20-BIT TIME CODE (GENERAL)
(NASA 1-HOUR BCD TIME CODE)



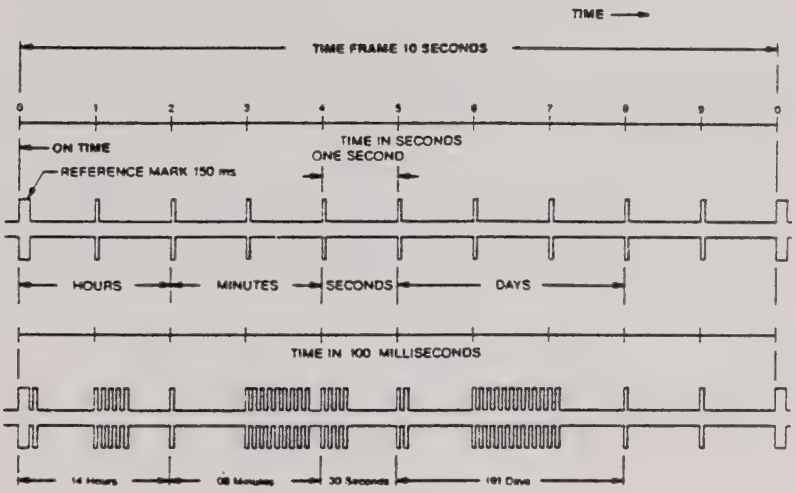
TYPICAL MODULATED CARRIER
(RECOMMENDED FREQUENCY: 100 Hz)

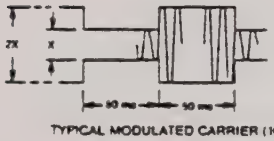
NASA 20-BIT
ONE-HOUR TIME CODE

1. **TIME FRAME:** 1 hour.
2. **CODE DIGIT WEIGHTING:** Binary Coded Decimal Time-of-Year CODE WORD — 16 binary digits. Hours and days; recycles yearly.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 1. Binary-coded elements occur between POSITION IDENTIFIER ELEMENTS in four-digit groups until the CODE WORD is complete. A CODE DIGIT occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per minute (basic Element Rate)
   b. 1 per hour (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 0.2 minutes (binary zero or uncoded Element).
   c. CODE DIGIT duration: 0.6 minutes (Binary One)
   d. POSITION IDENTIFIER duration: 0.6 minutes
   e. REFERENCE MARKER: Five consecutive POSITION IDENTIFIERS followed by an INDEX MARKER

   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the INDEX MARKER following the four POSITION IDENTIFIERS).
7. **RESOLUTION:** 1 minute (unmodulated); 10 milliseconds (modulated 100 Hz); 1 millisecond (modulated 1 kHz)
8. **CARRIER:** 100 Hz or 1 kHz when modulated.

NASA SERIAL DECIMAL — EXALTED CARRIER (APOLLO)



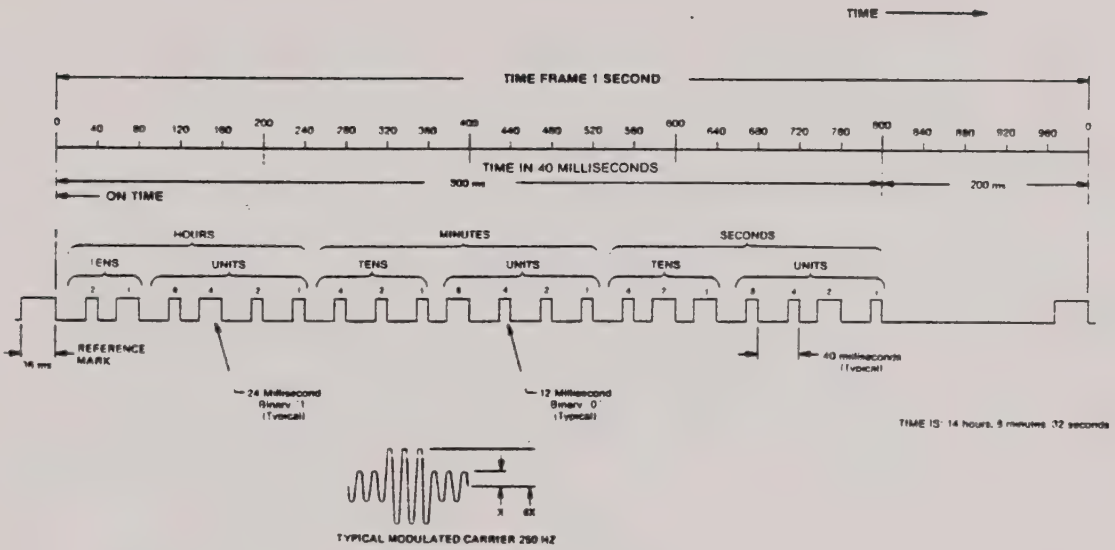


TYPICAL MODULATED CARRIER (1000 Hz)

NASA SERIAL DECIMAL CODE — EXALTED CARRIER — (Apollo)

The Exalted Carrier form of NASA serial decimal Time Code is exactly equal to the Suppressed Carrier format. The only difference lies in the method of modulating the 1000 Hz sinewave.

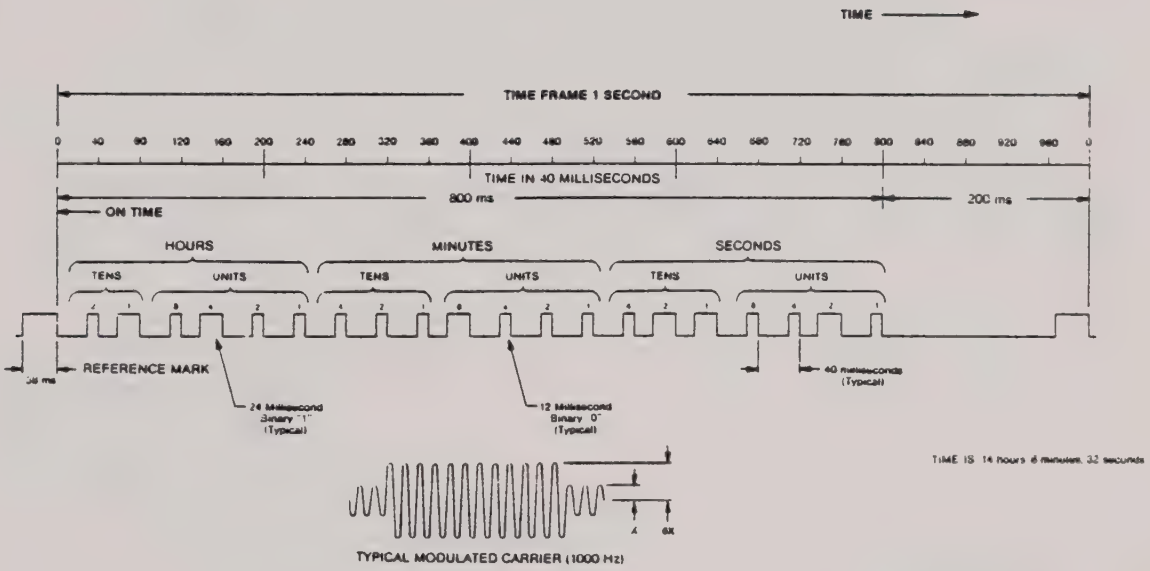
25 PPS — ONE SECOND — 250 Hz
XR3 FORMAT



25 PPS — ONE SECOND
TIME CODE
(250 Hz - XR3)

1. **TIME FRAME:** 1 second
2. **CODE DIGIT WEIGHTING:** BCD: Time-of-Day CODE WORD — 20 binary digits.
   a. Hours, minutes, seconds. Recycles every 24 hours.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 1. Binary-coded Elements occur consecutively (six for hours, seven for minutes, seven for seconds) until the CODE WORD is complete.
4. **MOST SIGNIFICANT DIGIT:**
   Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 25 per second (basic Element rate). (Four consecutive pulses missing at end of frame)
   b. 1 per second (Frame rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its trailing edge.
   b. Binary zero duration: 12 milliseconds
   c. CODE DIGIT duration: 24 milliseconds (Binary one)
   d. REFERENCE MARKER — 1 per second Duration: 36 milliseconds
   (The "On-Time" point, to which the CODE WORD refers, is the trailing edge of the REFERENCE MARKER).
7. **RESOLUTION:** 1 second (Frame Rate) (unmodulated). 40 milliseconds during CODE WORD only. 4 milliseconds (modulated).
8. **CARRIER FREQUENCY:** 250 Hz.

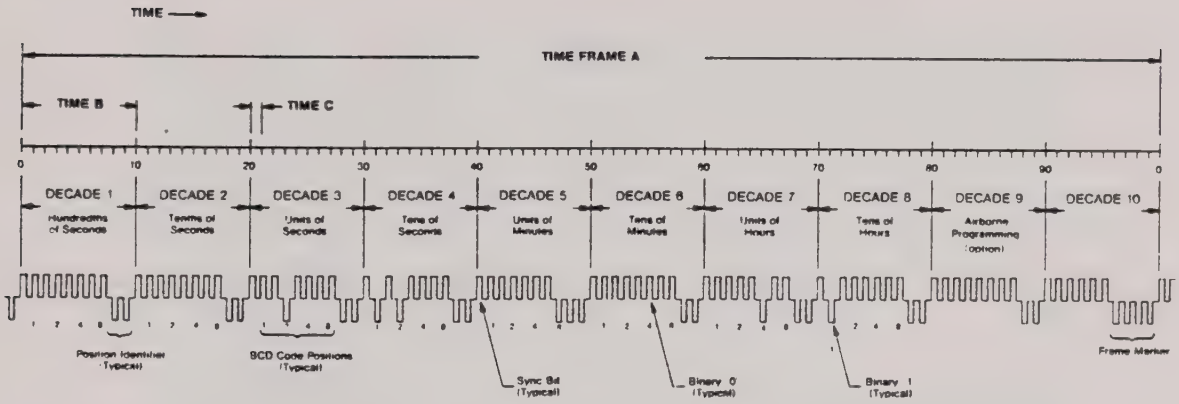
2137 FORMAT



25 PPS — ONE SECOND
TIME CODE
(1000 Hz - 2137)

The 2137 Format is exactly the same as the XR3 Format. The 2137 Format modulates a 1000 Hz carrier, thus provides a 1 millisecond resolution.

FEDERAL AVIATION ADMINISTRATION — NAFEC
TIME CODES



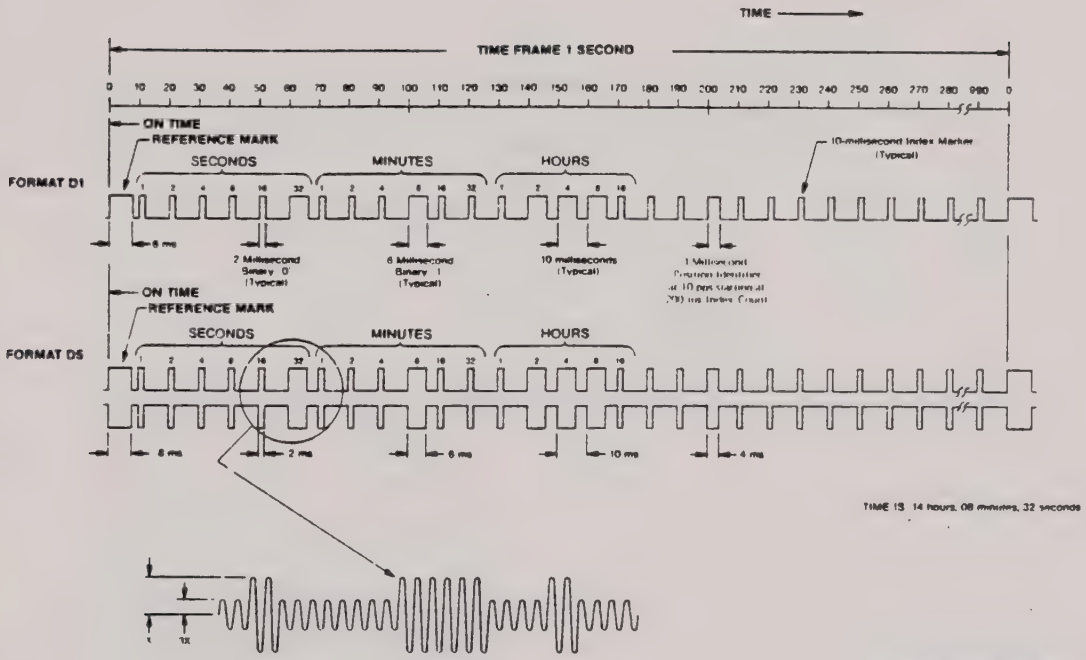
Time Code Frame Rate	TIME		
	A	B	C
1F/10 SEC	10 SEC	1 SEC	100 MS
1F/SEC	1 SEC	100 MS	10 MS
5F/SEC	200 MS	20 MS	2 MS
10F/SEC	100 MS	10 MS	1 MS
20F/SEC	50 MS	5 MS	500 µs

TIME IS: 14 hours 08 minutes 32.00 seconds

FEDERAL AVIATION AGENCY
NAFEC TIME CODE

1. **TIME FRAME:** Any of five from 10 seconds to 50 milliseconds.
2. **CODE DIGIT WEIGHTING:** Binary Coded Decimal Time-of-Day CODE WORD: from 30 binary digits (50 – ms TF) to 18 binary digits (10 – second TF).
   a. 0.01 seconds, 0.1 seconds, seconds, minutes and hours; recycles every 24 hours.
3. **CODE WORD STRUCTURE:**
   a. BCD word begins at INDEX COUNT 1. Binary-coded elements occur between POSITION IDENTIFIER ELEMENTS until the CODE WORD is complete. An INDEX MARKER occurs between each BCD digit and between each Decimal Group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   Variable from 10 per second (10-second Frame Rate) to 2000 per second (50-ms Frame Rate).
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: Variable from 50 milliseconds (10-second Frame) to 250 microseconds (50 ms Frame).
   INDEX MARKER is always positive amplitude (binary zero uncoded Element or Sync Mark).
   c. CODE DIGIT duration: Variable from 50 ms (10-second Frame) to 250 microseconds (50 ms Frame)
   CODE DIGIT is always negative amplitude (binary one).
   d. POSITION IDENTIFIER — same duration as INDEX MARKER — Position Identifier is always two Index Markers and negative in amplitude
   e. REFERENCE MARKER — four consecutive binary ones followed by an INDEX MARKER (binary zero)
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the INDEX MARKER following the four consecutive ones)
7. **RESOLUTION:** From 100 milliseconds (10 second Frame) to 500 microseconds (50 millisecond Frame)
8. **CARRIER:** Normally not Carrier modulated

ATLANTIC MISSILE RANGE
FORMAT D1/D5

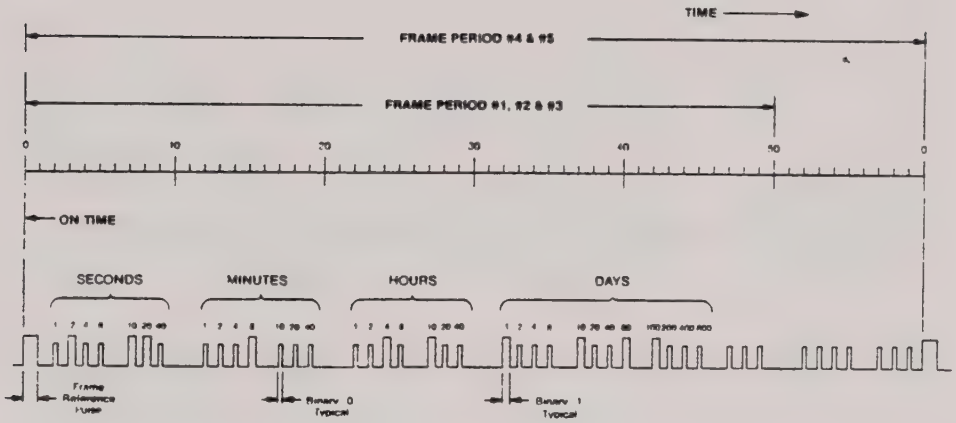


TYPICAL MODULATED CARRIER (1000 Hz)

ATLANTIC MISSILE RANGE FORMATS D1 AND D5

1. **TIME FRAME:** 1 second
2. **CODE DIGIT WEIGHTING:** Grouped Binary Time-of-Day CODE WORD — 17 binary digits.
   a. Seconds, minutes and hours. Recycles every 24 hours.
3. **CODE WORD STRUCTURE:**
   a. Binary word begins at INDEX COUNT 1. Grouped binary elements occur (six for seconds, six for minutes, five for hours) until the CODE WORD is complete.
4. **LEAST SIGNIFICANT DIGIT:** Occurs first.
5. **ELEMENT RATES AVAILABLE:**
   a. 100 per second (basic Element rate)
   b. 10 per second (INDEX MARKER)
   c. 1 per second (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each Element is its leading edge.
   b. INDEX MARKER duration: (100 PPS). 2 milliseconds (Binary zero or uncoded Element)
   c. INDEX MARKER duration: (10 PPS): 4 milliseconds
   d. CODE DIGIT duration: 6 milliseconds (Binary one)
   e. REFERENCE MARKER duration: 8 milliseconds
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the REFERENCE MARKER).
7. **RESOLUTION:** 10 milliseconds (unmodulated); 1 millisecond (modulated 1 kHz); D5 code
8. **CARRIER FREQUENCY:** 1 kHz — Code designation changed to D5.

DATUM BI-LEVEL SLOW-CODE (5-Rate Selectable)



TIME IS 191 Days 14 Hours 08 Minutes 32 Seconds

CODE	Pulse Rate	Frame Period	Binary Zero	Binary One	Frame Ref Pulse
1	50 pps	1 Sec	4 ms	10 ms	20 ms
2	10 pps	5 Sec	20 ms	50 ms	100 ms
3	5 pps	10 Sec	40 ms	100 ms	200 ms
4	1 pps	60 Sec	200 ms	500 ms	1000 ms
5	1 or 10s	10 Min	2 sec	5 sec	10 sec

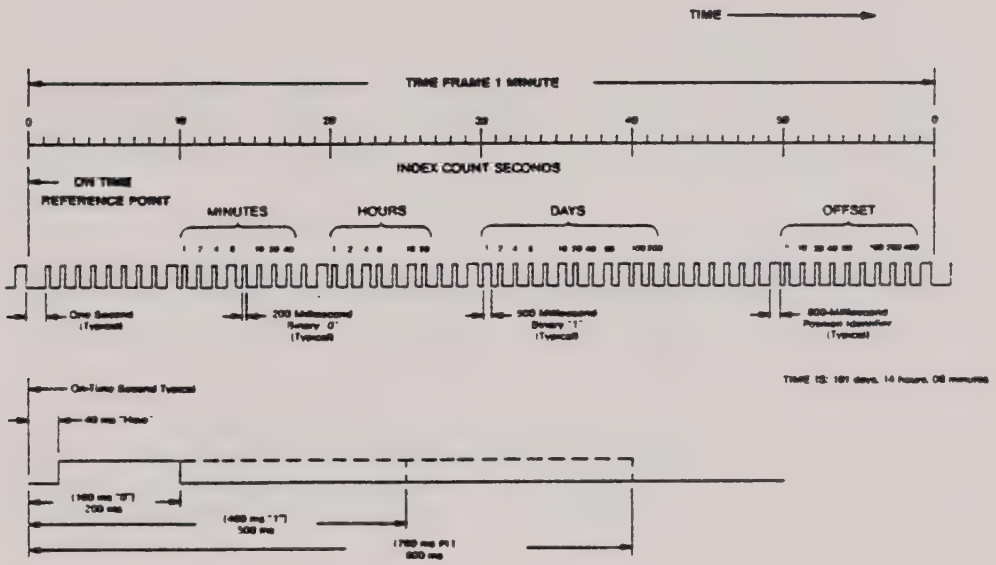
DATUM INC.
BI-LEVEL – 5-RATE
SLOW CODE

The DATUM special Bi-Level Slow-Code is designed to provide a convenient and efficient TIME REFERENCE for strip charts and oscillograph records. Five different and unique codes are provided to enable selection of the desired resolution consistent with the paper speed.

The CODE is width modulated, BCD Format. Amplitude modulation is also added to aid in the separation of the coded information.

Each Code Group is separated by a space to aid in fast recognition of the coded data without loss of resolution or inclusion of extraneous pulses. Coded information represents Time-of-Year in seconds, minutes, hours and days.

WWV/WWVH TIME FORMAT

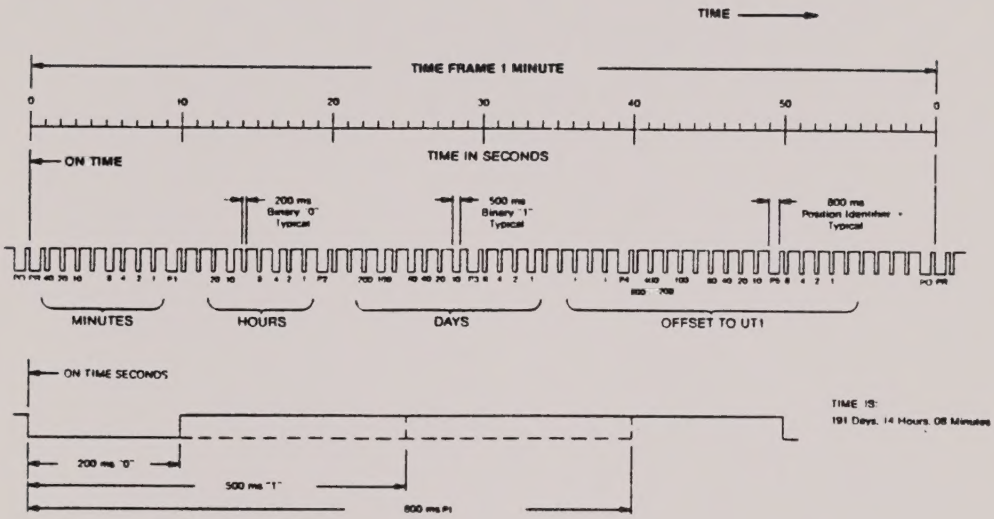


MODULATION: 100 Hz AT 100% MODULATION

NATIONAL BUREAU OF STANDARDS
WWV/WWVH
Standard Time Code Envelope

1. **TIME FRAME:** 1 minute
2. **CODE DIGIT WEIGHTING:** BCD Time-of-Year CODE WORD — 30 binary digits.
   a. Minutes, hours, days and UT correction. 0.01 seconds, 0.1 seconds.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 10 + 40 milliseconds. Binary-coded Elements occur between POSITION IDENTIFIER ELEMENTS (seven for minutes, six for hours, ten for days, seven for UT correction) until the CODE WORD is complete. POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** (Minutes) occurs first — UT correction occurs after days.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per second (basic ELEMENT rate)
   b. 1 per 10 seconds (POSITION IDENTIFIER Rate)
   c. 1 per minute (Frame Rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is 40 milliseconds before the element.
   b. INDEX MARKER duration: 160 milliseconds (Binary zero or uncoded element)
   c. CODE DIGIT duration: 460 milliseconds (Binary one)
   d. POSITION IDENTIFIER duration: 760 milliseconds
   e. REFERENCE MARKER — 1 per minute. One POSITION IDENTIFIER followed by a missing digit position. (The "On-Time" point, to which the CODE WORD refers, is the leading edge of an imaginary (missing) POSITION IDENTIFIER following a POSITION IDENTIFIER).
7. **RESOLUTION:** 1 second (unmodulated); 0.01 second (modulated 100 Hz) (theoretical)
8. **CARRIER:** 100 Hz — 100% modulation
9. **TIME SCALE:** Universal Time Coordinated with coded correction to UT1.

WWVB TIME FORMAT



NATIONAL BUREAU OF STANDARDS
WWVB TIME CODE
ONE-PPS CODE ENVELOPE

1. **TIME FRAME:** 1 minute
2. **CODE DIGIT WEIGHTING:** BCD Time-of-Year CODE WORD — 35 binary digits.
   a. Minutes, hours, days, UT correction 0.1 seconds, 0.01 seconds, 0.001 seconds.
3. **CODE WORD STRUCTURE:** BCD: Word begins at INDEX COUNT 1. Binary coded elements occur between POSITION IDENTIFIER ELEMENTS (seven for minutes, six for hours, ten for days, 12 for UT corrected) till the CODE WORD is complete. A POSITION IDENTIFIER occurs between decimal digits in each group to provide separation for visual resolution.
4. **LEAST SIGNIFICANT DIGIT:** (Minutes) occurs first — UT correction occurs after days.
5. **ELEMENT RATES AVAILABLE:**
   a. 1 per second (Basic Element Rate)
   b. 1 per 10 seconds (POSITION IDENTIFIER Rate)
   c. 1 per minute (Frame rate)
6. **ELEMENT IDENTIFICATION:**
   a. "On-Time" reference point for each element is its leading edge.
   b. INDEX MARKER duration: 0.2 seconds (Binary zero or uncoded element)
   c. CODE DIGIT duration: 0.5 seconds (Binary one)
   d. POSITION IDENTIFIER duration: 0.8 seconds
   e. REFERENCE MARKER — 1 per minute. Two consecutive POSITION IDENTIFIERS
   (The "On-Time" point, to which the CODE WORD refers, is the leading edge of the second POSITION IDENTIFIER).
7. **RESOLUTION:** 1 second (unmodulated)
8. **CARRIER:** 60 kH_Z (1:10 modulation ratio) suppressed carrier.
9. **TIME SCALE:** Universal Time Coordinated with coded correction to UT1.

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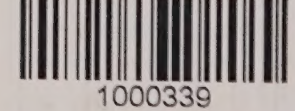

1000339

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